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# TUTOR'S GUIDE:

BEING

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# A Complete System of ARITHMETIC;

WITH H

# Various Branches in the MATHEMATICS.

#### In SIX PARTS. Viz.

I. Arithmetic in all its useful Rules, and to each a great Variety of Questions.

II. Vulgar Fractions, in all their

Parts.

III. Decimal Fractions, with the Extraction of Roots of different Powers; to which are added, Rules, &c. for the easy Calculation of Interest and Annuities, &c.

IV. Mensuration of both Superficies and Solids, applied to measuring Artificers Work, &c. with a Collection of Questions for Exercise. To which is added, the Specific Gravity of Metals, &c.

V. Chronology, or the Method of finding the several Cicles, Epids, Moveable Feasts, Time of High Water, &c. with a Collection of Questions relating to History; likewise all the most useful Examples on both the Globes.

VI. Algebra, wherein the Method of raifing and refolving Equations is rende ed easy, and illustrated with Variety of Examples and Numerical Questions.

To which is added,

# AN APPENDIX,

Containing different Forms of Acquittances, Bills of Ixchange, &c. &c.

The Whole being defigned for the Use of Schools, as a QUESTION BOOK or a REMEMBRANCER and INSTRUCTOR, to such who have some Knowledge of Figures, and is adapted for the Use of the Gentleman and Scholar, as well as for the Man of Business: And is recommended by several eminent Mathematicians and School-Masters.

The SECOND EDITION, corrected and improved, with Additions.

By CHARLES VYSE, Teacher of the Mathematics, Author of the Young Ladies' Accomptant, and Master of the Academy in O.d Round Court, Strand.

LONDON,

Printed for Robinson and Roberts, No. 25, in Pater-Notter-Row.

The Monthly Review, for January, 1771, gives the following Account of the first Edition.

"The best Method of conveying Instruction is derived from Experience; and tho' the Author of the Tutor's Guide does not pretend to boast of new Discoveries, yet it must be allowed, that he has selected a great Variety of necessary and useful Rules for the obtaining a thorough Knowledge in those Sciences which depend upon Arithmetic: And his Book will be found particularly useful in this Respect, that it contains a very confiderable Number of Questions to exemplify the Rules he has laid down, and to exercise the Attention of the Learner. - Many of them may be thought to furpass the Capacity of young Scholars; but this Circumstance is no just Objection against the Book itself; it rather recommends the Work to an after Review, when the Understanding is enlarged and ripened. The Plan and Execution of Mr. Vyfe's Performance do Honour to his Judgment and Application, and entitle it to the general Notice of those who are entrusted with the Education of Youth."

The CRITICAL Roy of gives the following Account.

"Notwithstanding there many Books already extant, upon the same Subject, yet we apprehend that the Work before us will not be deemed either unnecessary or impertinent, after having assured our Readers, it is recommended to the Favour of the Public by one of the most considerable Mathematical Writers of the present Age."

& Elizabeth Waglitain.

TO

# The Rev. Mr. VYSE,

Archdeacon of SALOP,

Canon Residentiary of the Church of Litchfield,

And Rector of St. Philip's Church, in Birmingham

This System of ARITHMETIC is,

With the utmost Deference, inscribed,

By

His most obliged

Humble Servant,

CHARLES VYSE.

The Rest Mark Till all Control

Archideacen of SALOP;

Canon Readentiary of the Charch of Lichent,

And Rector Charles and Hall Chief

Visit the almont Concerces Sufficient,

4 spiles host all.

Humble Servant,

CHARLES VYSE,

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Additions Subgradion Multiplication, and U.s.

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# BREFACE.

Schools; but I apprenend the anoff expect-

e Rule of Three, then Vink or and De-

WHEN we consider the utility of ARITH-METIC, on which Science almost all the others do absolutely depend, we need not be surprised that so many Efforts have been made to bring this useful Branch of Learning to the utmost Degree of Perfection: and although the vast Extent of the Subject does in some Measure defeat these Attempts; yet, upon Account of its real Value and Use, it certainly merits all the Study and Pains that can be bestowed upon it.

In the following Pages I have delivered the Definitions and Rules in as brief and concise a Manner as I possibly could, so as to make them general; and, in order to render those Rules more familiar to the Pupil, have, where neces-

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fary, given the Work at large to the first Exam-

ple in each Rule.

The feveral Rules follow in the same Order as specified in the Table of Contents: Thus, Book the First contains the four primary Rules, i. e. Addition, Subtraction, Multiplication, and Division in Integers, and Reduction, ascending and descending, with the Tables of Money, Weights, Measures, &c. with which the Pupil should be well acquainted, before he proceeds to the Use of

those Rules in Compound Numbers.

In Book the Second, the Rules follow in the same Order in which they are generally taught in Schools; but I apprehend the most expeditious Method for the Pupil would be to learn as far as the Rule of Three, then Vulgar and Decimal Fractions, the Extraction of the Square and Cube Roots; after which a larger Field may be opened to him, as he will be more capable to judge for himself, and (with a little Assistance from the Master) go through any Rule, to his own Satisfact on and his Teacher's Honour. But in Schools the Master very seldom either knows the Business for which his Scholars are designed, or the Length of Time they are to continue at School, and is therefore obliged to pursue the old beaten Path, and teach them first, what is not perhaps the most effential.

In this Work, amongst several hundred Questions, are all those most excellent ones of the late MARTIN CLARE, ranged according to the several Rules to which they appertain, a Thing

wished

wished for by School-Masters and Teachers in

I pretend not to boast of new Discoveries, but flatter myfelf to have felected every necessary and useful Rule or Proposition for obtaining a thorough Knowledge in those Sciences which depend upon Arithmetic; and have given a great Variety of such Questions as will enable the Tutor to supply his Pupils with those that may be most conducive to the Station of Life for which they may be defigned.

In this Edition I have felected the most difficult Questions of each Rule, as Exercites for leiter) a competent Knowledge of the leverior sind

And, in order to make this Book as ufeful as possible, I have added several Examples of the different Forms of Acquittances, Promissory Notes, Bills of Exchange, Bills of Parcels, &c. the frequent copying of which I would recommend to the Pupil.

I have not adjoined to this Edition the Anfwers to the Questions, as I intend speedily to publish (by Defire of several Mathematicians and Schoolmafters) a KEY to the TUTOR'S GUIDE, wherein all the Answers will be worked at Length, with proper References to the Questions as they stand in this Edition.

I need not point out the great Utility of such a Performance, it is sufficiently evident to all who are employed in this Branch of Education, especially such as have the Care of a numerous School, and experience the Difficulties that Teachers in general labour under with Respect

to Time; a Grievance that must still continue, while the Prices they receive are so very inade-

quate to their Labours. o fland or jen busing

I hope the Gentlemen of the Profession will do me the Justice to believe, that my Design in this Performance was not to dictate to, but ease the Master; and the skilful Teacher will, no doubt, vary the Work of the Questions according to the Nature of the several Rules.

The TUTOR'S GUIDE and its Key will furnish a Complete System of ARITHMETIC, and enable those, who are acquainted with the first Principles, to attain (without the Assistance of a Master) a competent Knowledge of the several Rules

with Ease and Precision.

The favourable Reception the first Edition met with gives me room to hope, that the Alterations and Additions I have made in this, will merit the Approbation of those Gentlemen who have kindly interested themselves in Behalf of my former Endeavours, to whom I return my most sincere Thanks, and am,

With the utmost Esteem and Respect,

subally for Defre of feveral Mathematic case

Their's and the Public's much obliged,

obedient humble Servant,

Old Round Court, Strand, Dec. 30, 1771.

CHARLES VYSE.

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Explanation of the Characters made Use of in this Book.

Problems in Superficials 201 phise Significations. how are hin A 10 Signs. Names. The Sign of Addition, as 6+2 is 8. + Plus or more. The Sign of Subtraction, as 6-2 is 4. Minus, or less. x { Multiplied ? The Sign of Multiplication, as 6x2 into, or by So salamagis 12. Divide by The Sign of Division, as 6+2 is 3. = Equal to The Sign of Equality, as 6+2=8. The Signs of Proportionals, as : SIs to :: \ So is \ \ . 1/2 : 4: 96 1 12. The Square Root of 8 is 2 18=4, and S Extraction of the Roots. 5 the Cube Root of 9 is 3 19=3 6-4×9=18: Signifies, that 6 less 4 multiplied by 9 == 18.

### The Twelve SIGNS of the ZODIAC.

Aries, the Ram.

Taurus, the Bull.

Gemini, the Twins.

Cancer, the Crab.

Leo, the Lion.

Virgo, the Virgin.

Libra, the Balance.

m Scorpio. the Scorpion.

Sagittarius, the Archer.

Capricornus, the Goat.

Aquarius, the Water-Bearer.

Prices the Fishes.

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# TUTOR'S GUIDE,

BEING

A Complete System of Arithmetic.

PART I. BOOK I.

Arishmetic in whole and compound Numbers.

# INTRODUCTION.

RITHMETIC is the Science, or Knowledge of Numbers, which is either Unit, or Multitude of Units.

8.

Unit is any thing confidered as one, or 1.

Digits or Figures are the Marks by which Numbers are denoted or expressed, and are the nine following, viz. 1, 2, 3, 4, 5 6, 7, 8, 9; with these there is used the Mark o, called a Cypher, which of itself stands for nothing, but being annexed to the right hand of a Digit, alters its value, thus 40 signifies forty, and 400 stands for four hundred, &c. (see the following Table.)

Integers or whole Numbers are such as express a Number or Multitude of Things, whereof each is considered as an Unit. Thus, 6 Pounds, 12 Yards, 140 Miles, &c. each

of which is called an Integer, or whole Number.

Compound Numbers are such as consist of different Denominations, as Pounds, Shillings, Pence, and Farthings; or Hundreds, Quarters, Pounds, Ounces, &c.

Thus, 471. 128. 61d. or 4C. 2 qrs. 14lb. &c.

B

A Fraction, or broken Number, is always less than Unit, as \(\frac{3}{8}\) represent three Quarters of any Thing or Unit, and \(\frac{6}{8}\), is fix-eights of Unit or 1, &c.

Arithmetic, with regard to Art and Science, confifts both

in Theory and Practice.

Theory confiders the Nature and Quality of Numbers,

and demonstrates the Reason of Practical Operations.

The Practice is that which shews the Method of working by Numbers, so as to be the most useful and expeditious for Business, and has sive principal or fundamental Rules for the Operation, viz.

1. Numeration of Notation, 2. Addition, 3. Subtraction, 4. Multiplication, and 5. Division.

#### Sect. I. NUMERATION

TEACHETH to read, or express the true Value of any Number when writ down; and consequently to write down any proposed Number according to its true Value; and this consistent of two Parts.

i. The due Order of placing down Figures.

2. The true valuing of each Figure in its Place, both of which are plainly exhibited in the following Table.

#### TABLE.

+ 6 Hundred of Millions.	+ o ∞ Tens of Millions.	4 o o 4 Millions.		+ o o o o Hundred of Thoulands.	+ o o o o o Tens of Thoufands.	+ 00000 Thousands.		+ booooo Hundreds.	+ 0000000 Tens.	+ 0 0 0 0 0 0 0 Units.
9	8	7		6	5	4	•	3	2	1
4	0	0	ð.	0	0	0	•	0	0	0
	4	0	•	0	0	0	•	0	0	0
		4	•	0	0	0		0	0	0
				4	0	0	•	0	0	0
		À			4	0	40	0	0	0
						4		0	0	. 0
								4	0	0
					-			and the same	. 4	0
		* 1								4

#### EXAMPLES.

Write down the Value of the following Numbers, in Words at length, viz. 94, 762, 3024, 37460, 142613, 6040390, 47639121, 790401950, and 79041955.

In Figures express

Seventy-feven. Four hundred and ninety. Six thousand and fifty-five. Seventeen thousand seven hundred and nine. Eight hundred thousand and two. Seven Millions Forty-four Thousand and seventy-four. Six Hundred. Ninety-four Million. Four hundred thousand and fixty.

#### NOTATION

of

-

of

By ROMAN Numerical Letters.

One, five, ten, fifty, hundred, five-hundred, thousand. I, V, X, L, C, D, M,

When a less numerical Letter stands before a greater, it must be taken from it, as I before V or X, and X before L or C, &c. Thus

four, nine, forty, ninety, &c. IV, IX, XL, XC.

When a lesser numerical Letter stands after a greater, it is to be added to it, Thus,

fix, eleven, fixty, one hundred and ten, VI, XI, LX, CX.

A line drawn over any Number less than a Thousand, fignifies so many Thousands, as LX, is fixty Thousand, C is one hundred Thousand, M, is one Million, &c.

Write down in common Figures the following Numbers expressed in Numerical Letters, viz.

XIX, CC, DC, DLX, MI, MDCCL, LXX, CX, MD, MDC.

Write down in numerical Letters the following Numbers expressed in common Figures, viz.

2), 104, 419, 1741, 2007, 17678, 10004, 674084

### 2. INTEGERS.

#### ADDITION

TEACHETH to add fundry Numbers together into one Sum, called the Total.

#### RULE.

1. Place all the Numbers of a like Name under one another, that is, units under units, tens under tens, hundreds

under hundreds, &c.

2. Begin with the Units, and fingly collect the Sum of each Row, and if their Sum be less than ten, set it down underneath its own Place; but if it exceeds ten, the excess is only to be set down, carrying one for every ten to the next Row, and so on, continuing to the last Row, at which set down the Total Amount.

#### PROOF.

Vary the adding, by beginning at the Top of the Sum, and reckon the Figures downwards, in the same Manner you added them upwards, and if the Sum comes the same as before, it is supposed to be right.

#### TABLE of ADDITION,

Which is to be got by heart, by those who are Beginners in this Science.

c)1	2	3	4	5	6	7	8	9
1 2	TO MAD LATER THE STATE OF				7.			10
2	14	15	6	7	8	9	10	11
3		6	7	8	9	10	II	I 2
4	A		8	9	10	11	12	13
5	*1.5			10	II	12	13	14
6	6.5			gran a	12	13	14	15
7						14	15	16
7 8		gois			2 480	U.S.E.	16	1.17
9						4		18

The manner of ufing the Table is thus: Take the greater of the two Digits, whose Sum is fought, in the upperLine, and the lesser on the less Hand Column, in the same Line with this, and underneath the other stands the Sum.

As suppose I wanted the Sum of 9 and 7, then I look for 9 on the Head of the Table, and in the same Line with 7 on the Side stands 16, the Sum.

EXAMPLES

#### EXAMPLES.

(1)	147279	(2) 176042	(3) 127492
	274042	47976	274614
	716914	274	27406
	472196	4	274
	417417	471472	24
	194746	469	4158
(4)	147747	(5) 2147426	(6) 174684
	74724	27494	147129
	2467	27.5	2984
	915	3746	100
	20	74	63
	6	2147	1074
(7)	174264 7416 271 147419 4176 47 7913 274	(8) 14768412 2131596 29418 274 71471041 219816 1427	(9) 174684 26276 174168 276 7 741705 27417 3570

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#### 3. SUBTRACTION

TEACHETH to take a leffer Number from a greater, and thereby shews the Difference or Remainder.

#### R U L E.

- 1. Place your Numbers according to the Direction given in Addition.
- 2. Begin at the right Hand, and subtract each under Figure, from that which stands over it, writing each Remainder.

  B 3 mainder

mainder under which it proceeds from, fo shall all the Re-

mainder together express the Difference required.

3. But when the under Figure exceeds that which stands over t, you must borrow ten (the same which you stopped at in Addition) from which take the lower Figure, and to that Difference add the upper Figure and the Sum set down, (always remembering to carry one to the next Figure on the Lest-hand, before you Subtract.

#### PROOF.

To the leffer Number add the Remainder, if the Sum be like the greater the Work is right.

#### TABLE of SUBTRACTION.

0	1	2	3	4	5	6	7	8	9
1	U			3					
2		0	1	2	3	4	5	6	17
3	1	an ag	0	I					
4 5				0		2			
5					0	I			-
6		100				0	-	2	
7							ė.		2
7 8 9								0	1
9	0.05					No.			0

Rem. unfold

The manner of using this Table is the same with that of Addition, only, instead of adding the Digits together, subtract them.

#### EXAMPLES.

(1) From Take	1472742	807467	(5)	17406542
Rem.	ALTON	i kan e	7) 4,	
Proof				
(2), Bough	10768475	(4) 2074176 1760184	(6)	7417065
	COMPANIES OF PROPERTY.	Call State of the same and the same		

From

#### Multiplication.

(7) From 10746142 (8) 12468409 (9) 2170684 Take 1786076 9147608 1100787

Rem.

n

(10) From 106742740 (11) 214200040 Take 74760946 107400760

4. MULTIPLICATION

TEACHETH how to increase any one Number by another, so often as there are Units in that Number by which the one is increased; and serves instead of many Additions.

To this Rule belong three principal Members, viza

I The Multiplicand, or Number to be increased, or multiplied.

2. The Multiplier, or Number by which the Multipli-

cand is increased, or multiplied.

3. The Product, or Number produced in multiplying.

Note, before any Operation can be performed in this Rule, it is absolutely necessary that the following Table be got by Heart; as the ready Performance of this and all the following Rules, entirely depends upon having a perfect Knowledge of it.

				T	A	B 1	L E	•			
1	2	. 3	4	5	6	7	8	9	10	II_	12
2	4	16	8	10	12	14	16	18	26	22	1 24
3	5	19	1-12	F-15	18	21	24	27	30	33	1 36
4	ø		16	20	24	28.	32	36	140	44	48
5	2	•		25	30	35	40	45	50	55	60
6	*							Control of the Contro	60	Charles and the same of	THE REAL PROPERTY.
7	F	Y See			gavis.	49	56	63	70	77	84
8	k			183			64	72	80	88	96
9			1,511		27.			.8 t	90	99	108
10					100				100	110	120
11		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		, 1				1		121	1.72
12	ide sic s	TO THE	interpress		e september (200 ca		1	100			144

#### USE of the TABLE.

Seek the greater of the two Digits in the upper Line, and underneath it against the lesser, taken in the Lest-Hand Column, is the Product sought. Thus, to multiply 9 by 6, feek 9 in the upper Line, and under it against 6 on the lest, is 54 the Product; and so of any other.

Note, for the Conveniency of dividing by 11, or 12, I have continued the Table to 12 times, or else, in Multipli-

cation it is only required to 9 times.

#### CASE I.

To multiply by a fingle Figure.

#### RULE.

1. Place the Multiplier underneath the Units Place of

the Multiplicand.

2 Multiply the Units Figure of the Multiplicand by the Multiplier, if their Product be less than ten, set it down under its own Place of Units; but if their Product exceeds ten, (or tens) then set down the excess only (as in Addition) and bear (or carry) the said ten (or tens) in mind, until you have multiplied the next Figure of the Multiplicand by the same Figure of the Multiplier, and to their Product add one for each ten borne in mind, setting down the excess of their Sum above ten (or tens) as before; and so proceed in the same Manner until all the Figures of the Multiplicand are multiplied by the Multiplier.

#### PROOF.

The most sure and unerring Way is by Division. But as the Learner is supposed not yet to know that Rule, cannot prove by it; let him therefore make the Multiplicand the Multiplier, and if the Product comes out the same as before,

the Work is right.

of) Arithmetic, do teach to prove Multiplication by the Cross. But this Method of proving Multiplication is not to be depended upon, as it will prove a Sum to be right, when at the same Time the Work is utterly false. But it will never prove a Sum salse that is right.

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	2000			-	-	-
EX		N/A		107 1 2 5		1 100
H		IVI	1.43			
11 42		***		-	-	

(1)	Multiplicand 417629	853 (2)	342719586
	Multiplier	2	. 3
	· ,——		

Product

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(3)	257683914	(4)	174295683	(5)	27496538°r.
				Sen (d A rej =	
(6)	749185623	(7)	262758394	(8)	376291845

SE CA

#### R U L E.

When the Multiplier confifts of several Figures.

1. Place each Figure in the Multiplier respectively under its own Kind in the Multiplicand.

2. Multiply the Multiplicand, by each Figure of the Multiplier, (as before) observing to place the first Figure of each respective Product underneath that Figure of the Multiplier, by which you multiply with.

3. Add the several Products together, and the Sum will be the defired (or whole) Product.

(9)	E 142737396 16		M P L 21607472 28.		) 1207 <b>6</b> 849
(12)	247567 475	(13)	317649 689	(14)	2706910 3746
(15)	147678	(16)	47299 73581	(17) 7	3581

(18) 764258 (19) 417396 (20) 2719064 417396 764258 1648736

#### CASE HI.

When Cyphers are intermixed with the Figures in the Multiplier.

#### RULE.

Omit them, and place the first Figure of each particular Product under its respective Multiplier.

#### EXAMPLES.

(21) 480746 (22) 10746047 (23) 804700625 900607 40100108 207008009

#### CASE IV.

When there are Cyphers at the Right Hand of either, or both the Multiplier and Multiplicand.

#### RULE.

Proceed as before, neglecting the Cyphers until the particular Products are added together, and to that Sum place the Number of Cyphers that are at the End of both Factors, on the Right Hand.

(24) 27460 (25) 1460900 (26) 2768000 2900 8700 24600

If it be required to multiply any Number by 10, 100, 1000, &c. it is only annexing the Cyphers of the Multiplier to the Right Hand of the Multiplicand, and the Work is done.

#### CASE V.

When the Multiplier is such a Number that any two Figures (in the Table) being multiplied together will produce it.

#### R U L E.

Multiply the given Number by one of those Figures, and that Product by the other, which will give the defired Product.

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#### EXAMPLES.

- (27) Multiply 24674 by 16. (28) Mul. 340764 by 28.
- (29) Mul. 142395 by 56. (30) Mul. 176848 by 63.
- (31) Mul. 420746 by 72. (32) Mul. 17093 by 81.
- (33) Mul. 43074 by 144: (34) Mul. 14068 by 132.

#### CASE VI.

When the Multiplier is any Number between 10 and

#### RULE.

Multiply by the Figure in the Units Place, and as you multiply, add to the Product of each fingle Figure that of the Multiplicand, which stands next on the Right Hand.

- (35) 142716 (36) 14276 (37) 146094 (38) 24176 11 12 12 14
- (39) 36142 (40) 176424 (41) 14609 (42) 18627-15 16 17 18
- (43) 142768 19

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#### c. DIVISION

EACHETH us to find how often one Number is contained in another, or to divide any Number or Quantity given, into any Parts affigned, and ferves instead of many Subtractions. In this Rule there are three Numbers real, and a fourth Accidental, viz.

- 1. The Dividend, or Number to be divided.
- 2. The Divifor, or Number by which you divide.
- 3. The Quotient, or Number that shews how often the Divisor is contained in the Dividend.

4. The

CE

4. The Remainder, which is always less than what you divide by.

#### CASE I.

When the Divisor is not greater than 12.

#### RULE.

First seek how often the Divisor is contained in the first Figure of the Dividend, or if in case the first Figure of the Dividend be less than the Divisor, then in the two first Figures of the Dividend, and set the Quotient Figure down accordingly, and if any thing remains, carry it to the next Figure in the Dividend, where it must be reckoned as so many tens, that is, if one remains you call it 10; if two, 20; if five, 50; and so on, bearing in mind the Remainder of each ligure, and adding it to the next, until you have made use of all the Figures in the Dividend. This is called short Division.

#### PROOF.

Multiply the Quotient by the Divisor, and as you multiply add in the Remainder (if any) or add the whole Remainder to the Product at last, and if it comes the same as the Dividend, the Work is right.

	2)1742636.	(2)	3)2764064.	(3) 4)2160742.
(4)	5)1076426.	(5)	6)71420954.	(6) 7)4674263.
(7)	8)2768096.		9)6768094.	(9) 11)2762764.
	) 12)276484.	14 18 19	rea <del>th boards</del> Calberra Asa Carsa Sector	considering and the consid

#### CASE II.

When the Divisor consists of many Places or Figures.

RULE

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#### RULE.

- 1. If the Divisor be a less Number than so many Figures taken in the Dividend, see how often the first Figure of the Divisor is contained in the first Figure of the Dividend, and the Figure which expresses it, is the first of the Quotient, by which multiply the Divisor, and place the Product under the said Figures of the Dividend, and draw a Line underneath it; Subtract it therefrom, and to the Remainder annex the following Figure of the Dividend, then proceeding as before.
- 2 But if it happen that the Divisor be a greater Number than so many Figures of the Dividend, then you must take a Number of Places in the Dividend greater by one, and see how often the first Figure in the Divisor is contained in the two first of the Dividend, Allowance being made for what you carry from the Figure on the Right.

3. If in any case the Remainder be so small that when the Figure of the Dividend joined with it, make a Sum less than the Divisor, then a Cypher is to be placed in the Quotient, and another Figure brought down, and then proceed as be-

fore; this is called Long Division.

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63.

64.

#### EXAMPLES.

	(16) 7489)1204530760(
(12) 84)35730972(	(17) :42163)112737328(
(13) 648)272357640(	(18) 61745)392628787(
(14) 759)30891829676(	(19) 684573)3233238699(
(15) 3065)63463902247(	(20) 476085)98839054780(
(21) 4728395	27750050255(

#### CASE III.

When the Divisor has Cyphers on the Right Hand.

#### RULE

Strike off so many of the last Figures in the Dividend, and divide by those Figures of the Divisor that are lest when the Cyphers are omitted. But when the Division is ended, those Cyphers so omitted in the Divisor, and the Figures cut off in the Dividend, are both to be restored to their own Places.

C

### EXAMPLES.

(22) 2800)11928248( (23) 172000)247004674(

When the Dividend has the same Number of o's on the Right Hand, as the Divisor, strike them off from each, and the Remainder will be so many of what you divide by, without annexing the o's that were struck off.

(24) 473000)351858000( (25) 6970000)599430000( C A S E IV.

When the Divisor is such a Number, that any two Figures (in the Multiplication Table) being multiplied together, will produce the said Divisor.

#### RULE.

Divide the given Number by one of those Figures, and that Quotient again by the other, which will give the Quotient required.

Note, Observe that if there he a Remainder in the last Division, it will be so many Times the first Divisor, which added to the first Remainder (if any) will give the true one.

#### EXAMPLES.

When the Learner is pretty well versed in Division he may fubtract each Figure of the Product, as he produces it, and so only write the Remainder, which will shorten the Work, and be much the best Way, (when the Divisor is small).

#### EXAMPI.ES.

(34) 17)690489( (36) -467)2148686( (35) 86)5343698( (37) 6074)24939844(

TABLES of ENGLISH COINS.

Marked			
q.	4 Farthings		Penny,
d.	12 Pence	make one	Shilling,
8,	4 Farthings 12 Pence 20 Shillings		Pound, L.

$$\begin{cases} \frac{1}{2} \\ \frac{1}{2} \\ \frac{1}{4} \end{cases}$$
 is wrote for 
$$\begin{cases} 1 \\ 2 \\ 3 \end{cases}$$

N

P 1	ENCET	A B	L E.	
d.	s. d.	.d.		5.
20 30 40 50 60	[ 1 8 ]	24)	ſ	2
30	2 6	36	77 1	3
-40	3 4	48		
50		60		4 5 6
60	4 2 5 0	7 <sup>2</sup> 8 <sub>4</sub> }		6
70 }	are \ 5 10	84 >	are <	78
80		96	21 P	
70 80 90	7 6	108		9
100		120		
110	9 2	132		II
120	[10 0 ]	1 144]	l	12

The WEIGHTS and VALUE of fuch GOLD and SILVER COINS, as are most commonly used in England.

is notice by R	odil	j et	Veig	ght	odi	10 1	aln	c
				mites.		1.	3.	d.
A Guinea	•	5	9	9	•	1	1	0
	•		16			0	10	6
A Quarter dit	to R.	1	8	7	1. v	•	5	3
A Crown	•		8	101	-	0	5	0
Half ditto	-			5	•		2	
A Shilling	-11		Victoria de la companya del la companya de la compa	18		Water State of	1	0
A Six-pence	iele.	A THE THIRD IN	22	The second secon		0	0	6

Note, 20 Mites make one Grain.

N. B. Besides the above Coins, we have a great deal of Portugal Money in use here, the Value and Weight of which is as follows.

	1.	5.	d.		dwis. gr.
A piece of	3	12	0	should weigh	18 16
Ditto of	1	16	0		9 6
Ditto of	0	18	0	1 0-6 11	4 15
Ditto of		9	0	_	2 71
A Moidore		7	0	and <del></del> metal	6 18
Half ditto	0	13	6	galain <del>a p</del> ylonai	3 9
Quarter ditto		6	7 . T. T. T.	Omet <del>a a</del>	1 16:

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28 64 81 132 may and ork,

A Pound Weight Avoirdupoise of Copper is coined into twenty-three Pence; consequently a Half-Penny is one third of an Ounce nearly; and a Farthing one fixth.

> is a Noble. Note is an Angel. is a Mark.

# REDUCTION

EACHETH to reduce all great Names into small, by multiplying the given Number with fo many of the next lower Name, as to make one of the higher, still keeping them equivalent in Value, and is called Reduction descending; on the contrary, all small Names are brought into great by dividing the given Number by to many of the lesser Name as make one of the next greater; this is the Converse of the last, and is termed Reduction ascending.

### EXAMPLES in MONEY.

1. In 271. how many Shillings and Pence?

2. Reduce 6480d. to Shillings and Pounds.

3. How many Shillings, Pence, and Farthings, are there in 401. 101? natilitie A

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2.

3.

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4. In 38880 Qrs. how many Pounds?

5. Reduce 1041. 171. 62d. to Farthings 2009 1. 2 A

6. How many Pounds in 100683 Qrs.?

7. In 21 Guineas, how many Shillings, Pence, and Fare things?

8. Reduce 21168 Farthings to Guineas.

9. In 42 Moidores how many Farthings?

10. How many Moidores in 54432 Farthings?

#### WEIGHTS and MEASURES.

#### TROY WEIGHT.

Marked	••••	0 0 0	lo civili
gr.	24 Grains	o pulled	Penny Weight.
dwts.	24 Grains 20 Penny Weights	make one	Ounce.
oz.		6 9 9 9	Pound:

By Troy Weight is weighed Gold, Silver, Jewels, Amber, Bread, Corn, and all Liquors, and from this Weight all Measures for wet and dry Commodities are taken.

N. B. 14 02. 11 dwts. 151 grs. Troy, is equal to 1 Pound

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#### EXAMPLES.

1. In 24lb. of Silver, how many Ounces, Penny Weights, and Grains ?

2. Reduce 138240 grs. to divis. oz. and 16.

3. In an Ingot of Silver weighing 12 lb. 1002. 22 grs. how many Grains?

4. Reduce 73942 grs. to Pounds.

### APOTHE CARIES WEIGHTS. \* +

larked			
grs.	20 Grains	1	Scruple.
3	3 Scruples 8 Drams	Carin and	Dram.
3	8 Drams	make ones	Ounce.
The state of the state of the	112 Ounces	J	Pound, 15.

Apothecaries, in making up their Medicines, use this Weight, but they buy and sell their Drugs by the Avoirdupoise Weight.

#### EX A M P L E S.

- 1: In 1416, how many Ounces, Drams, Scruples, & Grains?
- 2. Reduce 80640 grs. to 3, 3, 3, and 16.
- 3. How many Grains, in 416. 113, 29, 17 grs?
- 4. In 28377 grs. how many Pounds?

#### AVOIRDUPOISE. WEIGHT.

Marked dr.	E A S U R A G	n II Pic	(Ounce.
	16 Ounces		Pound.
	28 Pounds	make one	Quart, of Cwt.
	4 Quarters or 112lb.		Hundred.
cwt.	20 Hundred		Ton.
	do do		Laterian O a Rie

By Avoirdupoise Weight is weighed all Manner of Things that have Waste, as all Physical Drugs and Grocery, Rosin, Wax, Pitch, Tar, Tallow, Soap, Hemp, Flax, Hay, Wool, &c. All base Metal and Minerals, as Iron, Steel, Lead, Tin, Copper, Allum, Copperas, &c. Also Bread, Butter, Cheese, Salt, Butcher's Meat, &c.

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The Denominations in some of which are as follows, viz.

8 Pounds 7 Stone of Butchers Mest.

14 Pounds make one Stone of Horseman's Weight.

19 Hundreds \

#### WOOL WEIGHT.

7 Pounds
2 Cloves
3 make one Clove. 6 Todds
2 Weys
3 make 1 Sack. Last.

HAY.

56 Pounds of old Hay are Truss | Peck Loaf 1 6 7 6 1 Half ditto 8 11 1 2 36 Trusses are 1 Last. | Quartern ditto 4 5 8

BREAD.

Weight.

Note, There are some Sorts of Silk which are weighed by a great Pound of 24 oz.

#### EZXZAZM PALAEXS.

- 1. In r Ton, or 20 Cwt. how many Quarters, Pounds, Ounces, and Drams?
- 2. Reduce 573440 drs. to Hundreds, &c.
- 3. Reduce 27/b. 12 02. 11 drs. to Drams.
- 4. How many Pounds in 7115 drs.?
- 5. In 12 Tons, 10 cwt. 14 lb. 11 oz. 15 drs. how many drs.?
- 6. How many Tons are there in 717161 drs.?

#### CLOTH MEASURE.XX

A Nails		Quarter of a Yard	Marked.
3 Quarters	gand sales		Ell Fl.
4 Quarters	make one	Yard	Yd.
5 Quarters		Ell English	Ell Eng
6 Quarters		Ell French	Ell Fr.
			Scote

Scotch and Irish Linens are bought and fold by the Yard. but Dutch Linen, are bought by the Ell Flemish, and fold by the Ell English and Marker wed radril occasion and a Reduce 12 Les. 1 M. 6 Fun 29 volvell or

#### PLE A M

1. In a Piece of Cloth containing 24 Yards, how many Quarters and Nails?

2. Reduce 384 Nails to Yards.

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3. How many Nails are there in 72 Ell Eng. 4 grs. 2 na.?

4." Reduce 1458 Nails to Ells English ..

5. In 121 Ells Flemish, how many Nails?

6. Reduce 1452 Nails to Ells Flemish.

- 7. How many Nails in 42 Ells Fr. 5 grs ?
- 8. Reduce 1028 Nails to Ell French.

#### LONGMEASUREX

Marked.			.alchIbelled
b. c.	3 Barley Corns	1	finch.
in.	2 Inches		Foot.
f.	3 Feet or 36 Inches		Yard.
yd.	2 Yards or 6 Feet	ŭ	Fathom.
	52 Yards or 11 half-yds	(0)	Pale, Rod or Perels
p.	40 Poles or 220 yards	ak	Furlong.
fur.	8 Furlongs or 1760 yd.	<b>E</b>	Mile.
m.	3 Miles	A	League.
lea.	23 leagues or 69 miles	70.00	
360	Degrees are the Circumf	eren	e of the Globe.
	5 Feet is a Geomet	rical	Pace. A Arrol.

161 Feet is a Pole.

#### ALSO

Hand or Hand's Breath. 4 Inches 3 Hands Breadth Foot. make one 1 Foot Cubit. 2 Cubits Yard.

By this Measure Distances of Places, or any Thing elfe, that has Length only, are measured.

#### EXAMPLES.

- 1. In 176 m. 30 p. how many Poles?
- 2. Reduce 56350 Poles to Miles.

3. How many Yards, Feet, and Inches, are there in 200

4. In 12672000 Inches, how many Miles? In 11 11 11

g. Reduce 12 Lea. 1 M. 6 Fur. 29 P. 4 Yds. to Barley

6. In 7193178 b. c. how many Leagues, &c?

#### LAND MEASUREX

p. 40 Poles
4 Roods
20 Acres
100 Acres
4 Rood.
5 Rood.
5 Rood.
6 Rood.
7 Rood.
7 Rood.
8 Rood.
9 Rood.
100 Acres

The best Way of measuring Land, is by a Chain of 4 Poles, or 66 Feet long, which is divided in 100 equal Parts called Links.

In. b. c.

7 276
25 Links
4 Poles or 100 Links
or 22 Yards
To Chains

A Poles of 100 Links
To Chains

### EXAMPLES.

3. In 42 Acres, how many Roods and Poles ?

2. Reduce 6720 Poles to Acres

3. In 12A. 3 R. 29 P. how many Poles ?.

4. How many Acres in 2069 Perches?

#### WINE MEASURE.

of

Marked.		Property of the Park of the Pa
pts.		Quart.
qts.	4 Quarts or 8 Pints	Gallon.
	10 Gallons	Anchor of Br. or R.
	18 Gallons	Runlet.
A control	311 Gallons	Barrel.
	42 Gallons 2 Tierce, or 84 Gallons	Tierce.
tier.	2 Tierce, or 84 Gallons E	Puncheon, Punch.
	63 Gallons	Hogshead.
h.	2 Hogsheads or 126 Gal.	Pipe or Butt.
P	2 Pipes or 252 Gal.	(Tun
1 44 5		Mote

Note, A Tun of Wine is 18 Cwt. Avoirdupoise. A Gallon is 231 folid Inches.

By Wine Measure, all Spirits, Mead, Perry, Cyder, Vinegar, Oil, and Honey, &c. are measured, as also Milk, not by Law, but Custom only.

# EXAMPLES.

- 1. In 4 Anchors of Brandy, how many Gallons & Quarts?
- 2. In 160 Quarts, how many Anchors?

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- 3. Reduce 4 hhds. of Wine to Gallons and Pints.
- 4. How many Hogsheads of Wine in 2016 Pints?
  5. Reduce 42 Tierces and 24 Gallons to Pints.
- 6. How many Tierces in 14304 Pints.
- 7. In 4 tun, 1 p. 1 hhd. 42 gal. 6 pts. how many Pints?
- 8. Reduce 9918 Pints to Tuns, &c.

# WINCHESTER MEASURE,

· Called also, Ale and Beer Measure.

Merked.	2 Pints	Quart.
gts.	4 Quarts or 8 Pints	Gallon
gal.	8 Gallons, Aleor   make one	Ricking and a
	9 Gallons, Beer July 1 100	o Sand A
hr.	2 Firkins Aud op af of Galo bas	Kilderkin.
.akil.a	4 Firkins   50 3 36 Beer	Lacoustandinano è
	4 Firkins al bild 200 Beer	Make I barres 7
bar.	Barrel, or 1 1 48 Ale	make - Washed
	3 Kilderkins A 19 CZ Beer	make I Hoguead.
hhds	2 Hogheads or 3 Bar. or 108 Gal	But
	2 Hogsheads or 3 Bar. or 108 Gal 2 Butts or 236 Gallons	make one Tu.
	SI College to a Pitchin of Reas	

, of Gallons is a Firkin of Beer or Ale in of England except London.

A Hogshead of Ale or Beer is 282 folid Inches.

A Firkin of Soap or Herrings is the fame with that of The Aspidand Bulbet is a 81 fector wide, and 8 found Goods and meatured

#### EXAMPLES.

- 1. In 12 Barrels of Ale, how many Gallons and Quarts.
- 2. Reduce 1 536 Quarts of Ale to Barrels.

3. In 42 Barrels of Beer, how many Pints?
4. Reduce 120006 Pints of Beer, to Barrels.

5. In 6 hhds. 27 gal. 6 pts. of Ale, how many pts.?

6. How many hhds. of Ale in 2526 pts?

director.

7. How many gal. and pts. in 14 hhds. 47 gal. of Beer?

8. Reduce 6424 Pints of Beer to Hogsheads.

9. Reduce 6 tuns, 1 butt, 42 gal. of Beer to Quarts. 10. How many Tuns, &c. in 5784 Quarts of Beer.

#### DRY MEASURE.

Marked.	Late Control Washington	
pts.	2 Pints Crand Town	(Quart.
qts.	4 Quarts or 8 Pints	Gallon.
gal.	2 Gallons	Peck.
pks.	4 Pecks or 8 Gallons	Bushel.
bu.	Bushels make o	ne Comb.
c,7 1	2 Combs or 8 Bushels	Quarter
qrs.	G Quarters	Wey.
	2. Weys or 10 Quarters	He b Laft.

#### ALSO,

4 Quarters or 32 bu. } make one { Chaldron } of Corne

A Load of Corn is 5 Bushels

A Cart Load of ditto is 40 Bushels.

A Gallon contains 2684 folid Inches.

In measuring Sea Coal,
5 Pecks is one Bushel, Water Measure.
3 Bushels
9 Bushels
12 Sacks
21 Chaldrons

Sea Coal,
Vater Measure.
Sack.
Vater

Chaldron.

By Dry Measure, Corn, Salt, Coals, and all other Dry Goods are measured.

The standard Bushel is 182 Inches wide, and 8 Loches deep.

#### EXAMPLES

1. In 34 Quarters of Corn, how many Bushels, Pecks, Gallons, and Quarts ?

2. How

36

al

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erv

2. How many Quarters of Corn in 6144 qts.? 3. Reduce 30 cha. 26 bu. of Coals to Pecks.

. How many Chaldron of Coals in 5288 pks.?

. In 64 Lasts of Corn, how many weys, bu. and pks?

. How many Lasts in 20480 Pecks?

re.

Dry

nches

ecki,

How

#### T I M E.X

Time of itself is nothing, but from Thought Receives its Rise, by labouring Fancy wrought; From Things consider'd whilst we think on some, As present, some as past, or yet to come; No Thought can think on Time, that's still confest, But thinks on Things, in Motion or at Rest.

Marked.		5	
111	60 Thirds	1	Second.
fec.	60 Seconds	201	Minute.
m.	60 Minutes	v	Hour.
h.	24 Hours	o	Day.
d.	7 Days	0 4	Week.
w.	4 Weeks or 28 Days	make	Month.
mo.	52 Weeks, Day, 6Hours, or )	=	
	13 Months, 1 Day, 6 Hours or >		Year Julian.
	365 Days, 6 Hours		

365 Days, 5 Hours, 48 Minutes, 57 Seconds, 39 Thirds, make a Solar Year.

The Year is also divided in 12 unequal Calendar Months, alled.

January, February, March, April, May, June, July, August, September, October, November, December.

And to know how many Days are in each Month, oberve (to get by Heart) the following Lines.

Thirty Days hath September,
April, June, and November;
February bath towenty-eight alone,
And all the rest have thirty-one;
Except Leap-Year, and then's the Time,
February's Days are twenty-nine.

EXAMPLES.

# AMPLES

1. How many Hours, Minutes, and Seconds, are there i a Week or 7 Days?

2. In 604800 Seconds, how many Days?

3. Reduce 6 mo. 4 d. to sec.

4. In 14860800 fec. how many Months?

5. How many Seconds are there in a Julian Year, or in 36 Days, 6 Hours?

6. In 31557600 fec. how many Days?

7. How many Thirds are there in a Solar Year, (or in 36 Days, 5 Hours, 48 Minutes, 57 Seconds, and 39 Thirds

8. Reduce 1893416259 Thirds, to Days.

#### SQUARE or SUPERFICIAL MEASURE.

144 Squ	are Inches	( Squ	are Foot.
0	- Feet		- Yard.
301 -	Yards m		Pole.
40 -	Roods   ma	ake one \	- Rood.
		85561	- Acre.
	Acres	esselie.	- Mile.

2721 Feet is one Rod of Brick Work. 100 Square Feet is one Square of Flooring.

By this Measure are measured all Things in which Lengt 10 Square Charis = 1 of quene - fore and Breadth is only confidered.

#### EXAMPLE

- 1. In 42 Square Yards, how many Square Inches?
- 2. How many Square Yards in 54432 Square Inches? 3. Reduce 3 fq. 42 feet, 64 in. of flooring to Inches.
- 4. How many Squares are there in 49312 fq. Incnes?

#### CUBICK or SOLID MEASURE.

728 Solid Inches 27 Feet 40 — Feet of round Timber or 50 — Feet of hewn Timber	Solid Foot.
27 Feet	Yard.
40 - Feet of round Timber or ?	Tonorios
50 - Feet of hewn Timber	Louor ross
A Solid Yard of Earth is called	a Load.
THE THE PARTY OF A STATE OF THE	_ 0

108 Solid Feet (i. e.) 12 Feet long, 3 Feet broad, and 3 Feet deep, or commonly 14 Feet long, 3 Feet 1 Inch broad, and 3 Feet 1 Inch deep, is a Stack of Wood; 128 folid Feet, i.e. 8 Feet long, 4 Feet broad, and 4 deep is a Cord of Wood.

By this Measure are measured all Things, in which are

confidered length, breadth, and depth or thickness.

#### EXAMPLES.

1. In 27 folid Yards, how many Solid Inches?

2. Reduce 1259712 Solid Inches to Solid Yards.
3. How many Solid Inches are there in 4 Tons 24 feet of newn Timber?

4. In 387072 Solid Inches, how many Tons of hewn Fimber?

Of some Particular WARES or GOODS.

12 Dozen 12 Gross 20

5 Score

6 Score or 120

1200

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nes?

E.

Foot. Yard.

r Load

108 So

Dozen. Gross.

Great Gross.

make one \ Score.

Hundred.

Great Hundred:

Thousand.

#### END OF BOOK I.

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#### THE

# TUTOR'S GUIDE

### PART I. BOOK II.

#### EXERCISE in NUMERATION.

7. TN Figures express the following Numbers, viz. one Million and a half in South Sea Bonds.

2. Threefcore and twelve Thousand thirteen Hundred

Weight of Lead.

3. Fifteen Thousand and fourscore Million of Stivers.

4. One Hundred and twenty Thousand two Hundred and fixty Millions seventy Thousand seven Hundred and seven Rials of Plate.

5. Three Million and thirty-three Thousand and thirty

Pieces of Eight.

6. Four Thousand and forty Hundred Pounds, thirty-fow Shillings, and fourteen Pence, five Farthings.

#### ADDITION.

#### EXAMPLES of INTEGERS.

Add the following Numbers, viz. 140724, 296, 42, 6749 64167, 20, 2687, and 2684 together.

Again, add 27460, 176, 2900, 274, 1004, 64, 596, 41

and 6104 together.

Also, 867, 317, 69, 1720, 276842, 49, 426074, and 60 sogether.

## 7. COMPOUND ADDITION.

TEACHETH to add fundry Sums or Numbers together, having divers Denominations, as in Money, Weights, Measures, &c.

#### RULE.

1. Place the Numbers of a like Denomination under each other, viz. Pounds under Pounds, Shillings under Shillings,

Pence under Pence, Farthings under Farthings, &c.

2. Begin to add, at the lowest Denomination sirst, as in Integers, then divide that Sum by as many of the same Denomination, as make one of the next greater, setting down the Remainder under the Row added, and carry the Quotient to the next superior or greater Denomination, whose Sum you must also find; proceed in this Manner to the last (or greatest Denomination) which add as in Integers.

#### EXAMPLES of MONEY.

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<sup>(4)</sup> Add 270l. 16s. 6\frac{1}{2}d. 60l. 10\frac{1}{4}d. 60l. 10s. \frac{3}{4}d. 96l. 6s. 10d. 176l. 6s. 6\frac{1}{2}d. 2l. 2s. 16l. 17s. 6\frac{1}{2}d. and 100l. into one Sum.

(5) Add 260l. 17s. 67l. 101d. 17ol. 10s.  $\frac{1}{2}d$ . 10ol. 10s. 6\frac{1}{4}d. 16s. 6\frac{1}{4}d. 19s. \frac{1}{4}d. 37l. 11s. 11\frac{1}{2}d. 60ol. 10s. and 220l. 6\frac{1}{2}d. into one Sum.

(6) Add 2761. 175. 161. 10\frac{1}{4}d. 2691. 115. 11\frac{1}{2}d. 1071.

195. 101. 6d. 145. 11d. 3671. 175. 6\frac{1}{2}d. 125. 4\frac{1}{2}d. 201.

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## Addition.

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#### APPLICATION.

1: HOW many Days are there from June 1, 1772, to Jan. 27, 1773?

2. Suppose a Man to be born in the Year of our Lord 1772,

in what Year will he be 60 Years of Age?

3. A Gentleman left his eldest Daughter one Thousand Pounds more than the youngest, whose Fortune was eleven Thousand eleven Hundred and eleven; what was the eldest Daughter's Fortune, and what did the Father leave them?

4. In the Bissextile, or leap Year, how many Days in each

Month, and what is their Sum?

5. A owes such a Sum of Money, that if he paid seventeen Pounds seventeen Shillings and six Pence, the Remainder to pay will be eighty-two Pounds two Shillings and six Pence; required the Sum owed?

6. A Privateer took a Prize, the private Men's Share came to 4741. 175. 111d. and the Officers received as much, besides 4671. unknown to the private Men; how much

did the Officers receive?

7. A Nobleman, going out of Town, is informed by his Steward that his Corn-Chandler's Bill comes to 123l. 19s. His Brewer's to 4tl. 10s. His Butcher's 212l. 6d. To his Lordship's Baker is owing 24l. To his Tallow-chandler 13l. 8s. To his Taylor 137l. 9i. 9d. To his Draper 74l. 13s. 6d. His Coach-maker's Demand was 214l. 16s. 6d. His Wine Merchant's 68l. 12s. His Confectioner's 16l. 2s. His Rent 82 Guineas, and his Servants Wages, for Half a Year, came to 46l. 5s. What Money must he send to his Banker for, in Case

Case he would carry with him 501. to defray his Expences on the Road?

- 7. 6 d. thirty-eight Quarters of Beans, for 46l.

  7s. 6 d. thirty-eight Quarters of Beans, for 100l.

  twelve Quarters of Pease, which cost 16l. 16s. eighty
  eight Quarters of Barley, for 73l. 8d. sixteen ditto of
  Wheat, for 56l. 9s. 10d. and six Quarters of Rye, for
  4l. 4s. 6d. The Water-carriage of all comes to 13l.

  2s. 7d. his riding Charges to 1l. 13s. and if he clears
  eighteen Guineas by the Bargain, what do his Bills of
  Parcels amount to?
  - A Collector of Cash has been out with Bills, and gives an Account that A paid him 13l. and Half a Crown; B. 2l. 13s. C. 14s. and a Groat. D. 1l. 9s. 8½d. E. 11l. 6¼d. F. 17s. and a Tester. G. 12s. 2d. H. a Pound, and Half a Guinea. I. a Moidore, and 13s. K. Two broad Pieces of 23s. each, a Jacobus of 25s. and a Shilling. L. nine Pounds and a Mark. M. 12l. 12s. N. a Bank Note of 15l and O. three Crown Pieces and an Angel: What Cash had he in charge?

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- A of Amsterdam is Debtor to B. of Bristol for Mercery Wares, as per Factor, 4181. 25. 6d. for forty cwt. of Cheshire Cheese, 521. 185. for English broad Cloth, sistem Pieces, 3171. 125. 10d. for 19 Fodder of Lead,: 3201. for 12 Tons of Bar-iron, 1731. 3d. for eight Tons of Copper, 11101. 105. 1d. for his Acceptance of a Bill drawn, 881. 145. for another paid for honour, 501. tendedozen of Morocco Skins, 281. 155. 4d. paid Convoys, Insurance, and Port Charges, 431. Ware-house Room, Postage, Sledage, Boatage, and incidental Charges, 51. 55. The Factorage of all came to 1121. 65. For what Sum must B draw to clear the Account?
- In a Gentleman's Service of Plate there are fourteen Dishes, weighing 193 oz. 6 dwts. Plates thirty-six, weighing 421 oz. 11 dwts. four Dozen of Spoons, weighing 104 ounces, 6 dwts six Salts chased, weighing 32 oz. Knives and Forks, weighing 83 oz. 9 dwts. four Presenters weighing 113 oz. 4 dwts. in Mugs, Tumblers, Beakers, and other odd Pieces, wt. 264 oz. 18 dwts. A silver Tea-kettle and Lamp, weighing 126 oz. 9 dwts. and the rest of that Equipage 93 oz. 2 dwts. What Quantity of Plate had the Butler under his Care?

of which weighed 2 cwt. 2 qr. 10 lb. No. 2. 2 cwt. 1 qr. 16 lb. No. 3. 2 cwt. 24 lb. No. 4. 1 qr. 16 lb. besides a couple of Pockets, ditto, that weighed 58½ lb. each. How many Hundred Weight has he to pay Carriage for, on bringing them to Town?

13. A Gentleman at A. defired to know how far it was to E, and had the following Answer, viz. from hence to B is 39 m. 6 fur. thence to C, is 46 m. 24 p. thence to D, 60 m. 4 fur. 39 p. and thence to E, 37 m. 6 fur. What

is the Distance from A to E?

14. A Father was 28 Years old, (reckoning 13 Months to 1 Year, and 28 Days to one Month) when his eldest Child was born, betwixt the eldest and second were 2 Years, 10 Months, and 16 Days; betwixt the second and third were one Year, eleven Months; betwixt the third and fourth, were 3 Years, 7 Months, 25 Days, when the fourth is 16 Years, 9 Months, 27 Days. How old is the Father?

## QUESTIONS for Exercise at Leisure Hours.

15. How much is A (born 16 Years ago) older than B, who will come into the World fourteen Years hence?

16. A Person was 17 Years of Age 29 Years since, and he will be drowned 23 Years hence: Pray in what Year of

his Age will this happen?

17. A Person said he had 20 Children, and that it happened there was a Year and a half between each of their ages, his eldest was born when he was 24 Years old, and the Age of the youngest is now twenty-one; what was the

Father's Age?

18. A Sheep-Fold was robbed three Nights successively, the first Night half the Sheep were stolen and half a Sheep more; the second Night half the Remainder were lost and half a Sheep more; the last Night they took half what were lest, and half a Sheep more; by which time they were reduced to twenty; how many were then at first?

19. Find how many Years it was from the Creation of Adam to the universal Deluge in the Days of Noah, called Noah's Flood; by the 5th Chapter, and 6th Verse of

the 7th Chapter of Genefis.

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#### SUBTRACTION

### EXAMPLES of INTEGERS.

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#### 8. COMPOUND SUBTRACTION:

Teacheth to find the Difference between any two Sums of ivers Denominations, as Money, Weights and Measures, &c.

#### RULE.

Subtract as in Integers, only when the under Number of ay Denomination is greater than that which stands over it; prow so many of that Denomination as make one of the ext Superior, from which take the under Number, and to the Remainder add the upper Number, which Sum set down, membering to carry or add one to the next higher Denomination, before you Subtract.

#### EXAMPLES of MONEY.

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Punch. gal. qts.  Bought 14 64 2  Sold 10 72 3	pts. Tier.gal.	pts. Anch.gal.pts.
(16)  A.bhds.gal.qts.  From 24 41 2  Take 17 47 3	(17) B.bbds. gal.pt. 12 46 4 10 51 7	14 4 4
A.br. fir. gal. qt.  4. 0 From 42 2 4 2 6 2 Take 14 3 7 2	1 12 14	p. Cha. bu. p.
(6) 41. 2 From 12 1 4 4 2 74. 3 Take 8 0 4 7 3	14 2 4 21	D. b. m. fee. 264 14 24 41 107 21 41 56

#### APPLICATION.

L. Suppose a Person was born in the Year of our Lord seven teen Hundred and thirty-sive, how old is he this presen Year being 1772?

2. There are two Numbers, the greater is 102, and the

lesser 72, what is their Difference and Sum?

3. A. and B. having each a Sum of Money, A.'s Sum which is the greatest, is 741. 175. and the Differenced their Sums is 491. 135. 6d. I demand B's Sum?

4. Suppose I borrow 1001. and pay in Part 411. 175. 6d. ho

much remains to pay?

5. Suppose a Gentleman has an Estate of 6001. per Annum and he pays Land-Tax 1401. also for Repairs 941. 178

6d. what is his neat Estate per Annum?

6. A Person dying left 131111. 105. 6d. between his So and Daughter; the Daughter was to have eleven Thousand, eleven Hundred and eleven Pounds, what we the Son's Fortune?

7. A Horse in his Furniture is worth 351. 10s. out of it 121

that of the Horse?

8 A Trader failing was indebted to A. 71l. 12s. 6d. To B. 34l. 9s. 9d. To C. 16l. 8s. 8d. To D. 44l. To B. 66l. 7s. 6d. To F. 11l. 2s. 3d. To G. 19l. 19s. and to H. a fine of 30 Marks. At the Time of this Difalter he had by him in Cash 3l. 13s. 6d. in Commodition he had 23l. 10s. in Houshold Furniture 13l. 8s. 6d. in Plate 7l. 18s. 5d. in a Tenement 56l. 15s. in recoverable Book Debts, 87l. 13s. 10d. Supposing these Things faithfully surrendered to his Creditors, what will they then lose by him?

He then paid off 40 Guineas, and gave a fresh Bond for what was behind. By the Time there was 131. 44. 8d. due on the second for Interest, he paid off 371. 144. 2d. more; took up the old Bond, and signed a new one still for the Residue, the Principal again ran on till there was 91. 115. 3d. more due, and then he determined to take it up; pray what Money had his Creditor

to receive?

10. A Chaife, Horse, and Harness, were all together valued at 501. the Horse in Harness was worth 381. 16s. 6d.

the

the Chaise and Harness were estimated at 13 Guineas;

their several Valuations are required?

A Merchant taking an Inventory of his Capital, finds in his Vaults 28 Puncheons of Brandy, which cost him 8741. 10s. 6d. Bourdeaux Claret, 40 Tuns, which stood him in 7541. 4s. 22 Lasts, 4 Bushels of Corn in his Granary, worth 675l. 17s. 3d. with 2 Lasts of Canary Seed worth 113/. In his Warehouse were 10 Casks of Indigo, worth 6321. 12s. A Parcel of Saffron worth 2531. 5s. W.P. of Stafford owed him 3841. 10s. In the Hands of F. G. at Lynn, he had Wines to the Amount of 10111. 10s. Pepper in the keeping of S. Q. of the Custom-house, Value 15521. 16s. 8d. besides which R. O. owes him on Bond 300l. and T. M. on Note 260l. 141. He has in India Bonds to the Value of 4591. and the Interest of those Securities made 251. 145. 6d. He had Bank-Stock to the Value of 21341. 45 6d. There lay in his Banker's Hands 1892l. 17s. 6d. He was at this Time indebted to D. E. 713l. 13s. To M. F. 352l. 10s. 8d. to L. P. the Foot of his Account, 172 Guineas. To J. B. on Balance 571. 125. 10d. To an Insurance 1901. present State of this Person's Fortune is required?

had in Cash, Commodities, the Stocks, and good Debts 11505l. 10s. He cleared the first Year by Commerce 393l. 13s. 1d. What was his neat Balance at the Year's

End?

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Received from my Factor at Alicant, on Account of Sales of Tin, to the Value of 1971. 125. Sterling; of Bees-Wax to 711. 75. 6d. of Stockings to 471. 35. 6d. of Tobacco, the net Proceeds whereof were 9431. 155. 10d. of Cotton 1231. 35. 7d. and of Wheat to the Amount of 1161. 55. 6d. He at the same Time advises, that he has, per, Order, shipped for my Account and Risk, Alicant Wines to the Value of 2261. 165. 6d. Figs of 1571. 115. 3d. Fruit, 90 Chests cost 1041. 6s. Olives, 1361. 105. Oil, 1931. 175. Raisins, 1431. 4d. and Spanish Wool to the Value of 751. 135. 8d. the Commission of the whole Consignment came to 711. 185. 11d. The Question is, which of 1s is to draw for the Difference, and how much?

Jacob by Contract was to serve Laban for his two Daughters 14 Years; and when he had accomplished 11 Years,

L

11 Months,

11 Months, 11 Weeks, 11 Days, 11 Hours, and 11

Minutes, pray how long had he to ferve?

15. A. B. and C. open an Account with a Banker, Jan. 11, 1769, and put into his Hands, viz. A. 17 Guineas, B. 341. 115. 6d. C. 281. 185. 10d. On the 21st. A. withdrew 91. 10s. and C. advanced 121. and a Crown. The 24th B. called for 61. 10s. The 30th C. wanted 191. 84. 4d. on the 12th of Feb. B. deposited with him elever Carolus's each 23s. and 3 Moidores. On the 19th, A. sent for 51. and a Noble more; but on the 24th returned him 421. On the 2d of March, C. paid in twenty Guineas, and B. drew for fix. The 14th B. sent in 174. 8s. 8d. and the 17th A. had back 121. 2s. 6d. On the 19th they sent for five Guineas a Man, and on the 24th they returned that Sum, and ten Marks a-piece more; how much did their said Banker owe them jointly and separately at Lady-Day?

16. Received in Lieu of two Gold Repeaters, sent to Jamaica in 1767, the five Chests of Indico following; and on a like Adventure in 1769, the subsequent five Chests.

The Question is, how much Indigo I had less the se

cond Time than the first?

Anno 1767.	cwt.	qr.	lb.	- DEDW	lb. A	. 1769.	cwt.	qrs	. 1b.		16,
No. 1.	2	1	16	Tare	43					Tare	32
2.	2	2	II		47		1	3	17		32
.3.	2	0	12						10		30
4.	2	0	19		42		1	0	13		27
5.	2	3	17		49		2	0	11		34

draw upon it in the following Manner, viz. June 4
1769, Z. sent in 70l. 8s. Y. had 116l. 14s. 10d. re
maining on Balance, and the 14th sent in 120l. more
W. paid in 47l. 18s. 2d. in Cash, and delivered a Bank
Note for 200l. X. paid in a Bill of Exchange, on a good
Man, for 33l. 14s. 9d. and in Cash made it up 100l
Y. on the 16th drew for 43l. 12s. 6d. and the 20th 2
for eleven Guineas. W. on the 24th added 14l. 12
10d and X. withdrew 47l. 10s. 8d. Y. on the 28th paid
in 18l. 5s. and two Days after drew for 88l. 13s. 4
W. sent for 63 Guineas on the 30th, and in five Day
after for 15l. 10s. 9d. more. Z. on the 7th of Julydo
manded 12l. 8s. 3d. and X. 7l. 3s. 1d. Z. on the 15

24

25

remitted them 31l. 12s. 4d. and per Assignment, they received for him at the same Time double that Sum. Y. required 81l. 19s. 8d. on the 12th and W. ten-Guineas. Y. three Days after that, sent in 42l. and W. 52l. On the 19th X. sent for 38l. 18s. 10d. and the 24th paid in 19 Guineas. The Question is, how stood these Gentlemen's Cash severally, and what Money can they jointly raise?

QUESTIONS for Exercise at Leisure Hours.

18. Having a Piece of Ground 127 Feet in Front, let off to A 57 Feet, to build on at one End; and to B, at first 27½ Feet, which he afterwards, by Consent, extended to 42 Feet, what Ground was left me in the Centre?

19. If I am 42 Years older than you now, what will be the Difference of our Ages 14 Years after my Decease, in

case you should then survive?

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20. Of the noble Family of Cornaro, the Grandsire's Age was 134 Years, and he was 93 Years older than the Son, at the Time when the Son and Father's Ages together made 112 Years; distinguish their Ages.

21. B was 14 Years old when C was 25, how old shall C be,

when B comes to be 25?

22. What is the difference between the Ages of A, born in the Year 1693, and B, that will be born 13 Years hence,

the Question being put in the Year 1772?

Weather, it may be demonstrated, that there presses upon a human Body about 33905 Pounds of that fluid Matter; and in foul Weather, when the Air is most light, but 30624 Pounds. What Difference of Weight lies on such a Body, in the two greatest Alterations of the Weather?

24. Hipparchus and Archimedes of Syracuse, about 200 Years before Christ; Posidonius 50 Years before the said grand Period, and Ptolemy 140 Years after it, all advanced the Science of Astronomy. How long did each of these Persons slourish before the Year of Christ, 1769?

25. In the City of Pekin in China, is a Bell weighing, it is faid, 120000lb. at Nankin, in the fame Country, is another weighing 50000lb. The first exceeds the great Bell at Erfurd, in Upper Saxony, by 94600lb. How much then is the German Bell inferior in Weight to the Second?

26. Your Grandfather, if living, is 119 Years of Age, your Father actually 65; you are not so old as your Grandfire by 83 Years: What is the Difference in Years between your Father and you?

27. A Snail in getting up a May-Pole, only 20 Feet high, was observed to climb eight Feet every Day; but every Night it came down again four Feet: in what Time by

this Method did he reach the Top of the Pole?

28. A. is 13 Years younger than B, and 17 Years older than C, who in the Year 1747 was known to be 24 Years of Age: How old was each of these Persons in 1772?

29. A public Edifice was finished towards the Close of the 10th of King John, who began his Reign 134 Years after the Conquest in 1066; and it stood till within 70 Years of the Peace of Utrecht, in 1713; of what Duration was it?

30. A Grant was made by the Crown, Anno 1239, which was forfeited 137 Years before the Revolution in 1688;

How long did the same subfift?

31. Moses was born Anno Mundi 2433: Homer 832 Years
after him; Julius Cæsar lived 40 Years before our Saviour, and Alexander 312 Years before Cæsar; now as
Christ was incarnate 4000 Years after the Creation, the
Sum of the Intervals between Homer and the three great

Personages last mentioned is required.

72. The Semi-diameter of the Earth's Orbit, or annual Pater round the Sun, in the Centre of the System, is about 81,000,000 of Miles, that of Venus 59,000,000; when they are both on the same Side the Sun, they are in Perigao; when on different Sides, in Apogao. What is the Difference of their Distances in both these Circumstances?

33. B was born 14 Years after C, who came into the World
19 Years before A, who was 23 Years of Age eight
Years ago: What then is the Age of D, who is within
22 Years of being as old as those three together?

34. Arphaxad was born to Shem two Years after the Deluge, and 500 before his Father's Death; but at 35 Years of Age he had Selah, who at 30 was Father to Eher; who at 34 had Peleg; and he lived 430 Years after that: The Question is, whether Shem or Eber died the first and at nine-score and sourceen Years after the Death of

the longest liver, what Interval might be wanting to complete the Term of 1000 Years after the Flood?

35. K. is 19 Years older than L, who was 27 Years of Age in the South Sea Year, 1720: How old is M. in 1740, who, in the Year 1738, was within 24 Years of being as old as both of them together?

36. A, born Anno Christi 318, lived 207 Years before B, who lived 104 Years after C, who was Successor to D 84 Years. E was also 112 Years after D, but Predecessor to F by 47 Years: In what Year of Christ did

each of these Gentlemen flourish?

37. Sam was born 28 Years before Toby, who died at 12, and lived 19 Years after him. Rachel came to light when Sam was 16, and died 11 Years before him. Jofhua, when Rachel was 7 Years, being himself then 14, went abroad, where he continued 9 Years, and returning, survived Rachel four Years: How old was each of these, and what is the Sum of their Ages?

38. B, born Anno 1108, lived 48 Years before C, who was 113 Years Senior to D, and X was 114 Years before Y, who was 74 Years after Z, born Anno 1527: In what

Years of Christ were these Men severally born?

39. You were born 34 Years after me; how old shall I be when you are 17? and how old will you be when I am

70 Years of Age?

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viz. 1. The Invention of the Compass. 2. Gun-powder. 3. Printing. 4. The Discovery of America. 5. Truth, in the Reformation. The last was brought about Anno 1517, the third 77 Years before; the second 42 Years after the first, and the sourch 148 Years after the second. The Question is, in what Year of Christ did each of these happen to be found?

Three and thirty Years before the Restoration in 1660, the Crown granted Demesnes to certain Uses for 210 Years then to come. The Proprietor in 1715, procured a reversionary Grant for 99 Years, to commence after the Expiration of the first: In what Year of Christ.

will the second Term end?

2. A was born when B was 18 Years of Age; how old fhall A be when B is 4.1? and what will be the Age of B, when A is 7.2?

E 3

43. The Building of Solomon's Temple was in the Year of the World 3000: Troy was by Computation built 44; Years before the Temple, and 260 before London; Now Carthage was built 113 Years before Rome, founded 744 Years before Christ, born Anno Mundi 4000, is London or Carthage the ancienter City, and how much?

44. If the mean Distance between the Earth and Sun be 81 Million of Miles, and between the Earth and Moon 240 Thousands; how far are those two Luminaries a funder in an Eclipse of the Sun, when the Moon is lineally between the Earth and Sun? and in another of the Moon, when the Earth is in a Line between her

and him?

45. From the Creation to the Flood was 1656 Years; thence to the Building of Solomon's Temple 1336 Years; thence to Mahomet, who lived 622 Years after Christ 1630 Years: In what Year of the World was Christ

then born?

46. Seth was born when Adam was 130 Years of Age, and 800 Years before our faid Grandsire's Death: Seth at the Age of 105 Years had Enos: He, at 90, was Father to Canaan, who at 70 had Mahaleel. This Man at 65 begat Jared, who, having lived 162 Years, was Father to Enoch: this Patriarch at 65 Years of Age had Methuselah; and by the Time he was 187 Years of Age, his Son Lamech came into the World, who at 182 Years old was Father to Noah: and when Noah was 600 Years old, the Flood swept away the Bulk of Mankind. In what Year of the World did this happen, and how long after the Death of Adam?

47. Miss Kitty told her Sister Charlotte, whose Father had before left them twelve Thousand twelve Hundred Pounds a piece, that their Grandmother by Will had raised her Fortune to sisteen Thousand Pounds, and had made her own twenty Thousand: pray what did

the old Lady leave between them.

48. The Powder Plot was discovered 88 Years after the Reformation in 1517: The Murder of King Charles the First was committed 43 Years after that Discovery: The Accession of the Brunswick Family to the Crown was in 1714; just 54 Years after the Return of King Charles the Second, who had lived in Exile ever fince

the Death of his Father Charles the First: How long was that?

9. B, born 161 Years ago, died when C was 47 Years of Age, who it feems came into the World 180 Years fince, and out-lived B 43 Years: The Sum of their Ages is required?

o. If Sampson was born 17 Years after Timothy, and Timothy 26 Years before Jacob, who 28 Years hence will be just 50: In what Year of Christ were they severally born; the Question being proposed Anno 1772?

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1. A, born 445 Years before the Year 1733, died Anno 1362; B, born 37 Years ago, will die 18 Years hence; C, born 256 Years ago, died 197 Years fince; D, born Anno 1578, lived till within 75 Years of the faid 1733: The Length of these People's Lives is severally required?

2. A, born Anno 1441, lived till B was 7 Years of Age, which was 23 Years before the Reformation in 1517. B survived this remarkable Æra just 49 Years; C, born 9 Years after the Death of A, lived but till B was 36 Years of Age: The Sum of the Ages of these three Persons is required?

A, born Anno 1438, died at 48 Years of Age; B died Anno 1502, aged threefcore and seventeen; C, in the Year 1577, was 22 Years of Age, and survived that Time 54 Years; D, Anno 1616, had lived just half his Time, and died in 1648; E was 13 Years old at the Death of D, and 14 Years after that was Father to F, who was 31 when his Son G. was born, who at his Grandsire's Death was 7 Years of Age: The Years of Christ, wherein these Men were born, and the Years wherein the first sive of them died, are severally required?

A, born 17 Years after C, and 13 before B, died 42 Years before King George the Second's Inauguration in 1727, aged 47 Years; A died Anno 1712, and B, exactly 8 Years before him; D, born 23 Years before C, died at 64; E, born 11 Years after B's Death, will die 12 Years after the Year 1733; and F, born just in the Midway of the Interval, between the Birth of A and D.'s, is not to reach the Time of Death by 14 Years; what is the Sum of all their Ages, and which of them lived longest?

EXAMPLES

#### EXAMPLES of INTEGERS.

$$\begin{cases}
(1) \stackrel{>}{\longrightarrow} \begin{cases} 14276084 \\ (2) \stackrel{>}{\Longrightarrow} \begin{cases} 20749509 \\ 1204674 \\ 4074746 \end{cases} & by \begin{cases} 4 & (5) \stackrel{>}{\longrightarrow} \begin{cases} 147624 \\ 42768 \\ 10646 \end{cases} \\ (7) \stackrel{>}{\Longrightarrow} \begin{cases} 10646 \\ 407476 \end{cases} & by \begin{cases} 74 \\ 527 \\ 3967 \end{cases} \\ (9) \stackrel{>}{\longrightarrow} \begin{cases} 3142708 \\ (10) \stackrel{>}{\Longrightarrow} \begin{cases} 3142708 \\ 27680709 \\ (11) \stackrel{>}{\Longrightarrow} \end{cases} & 467852 \\ 40700609 \\ 4100 \\ 954000 \end{cases}$$

## 9. COMPOUND MULTPLICATION.

Teacheth to multiply (by one common Multiplier) as Sum or Number confifting of divers Denominations.

Case I. When the given Quantity doth not exceed 12.

#### RULE.

1. Write the Multiplier (or given Quantity) under the low Denomination of the Multiplicand.

2. Multiply the Number of the lowest Denomination by the Multiplier, and divide that Product by as many of the as make one of the next higher Denomination, the same which you stopped at in Addition, set down the Remainder underneath its own Place, and add the Quitient to the next superior Denomination, as you Multiply; in this Manner proceed with all the other Deminations to the highest.

### EXAMPLES of MONEY.

		f.	5.	d.	ſ.	s. d.		e. 1.
(I)	Multiply By	14	17	11	140	s. d.	41 14 15 1	7 6
	Бу	10100		2	O to Sa	6	1 616	

Product

4 Yards of Cloth, at 17s. 62d. per Yard. Ex. 1. 17s. 62d.

Answer, £. 3 10 2

2. 5 Hu

5 Hundred of Cheese at 31. os. 6d. per Cwt.

Ells of Holland, at 7s. 10d. per Ell.

8 Pounds of Tea, at 181. 91d. per lb.

9 Gallons of Wine, at 125. 8d. per Gall.

10 Anchors of Brandy, at 21. 6s. 4d. per Anch.

11 Barrels of small Beer, at 125. 7d. per Barrel.

#### CASE II.

When the given Quantity exceeds 12, and is fuch a umber that any two Figures (in the Multiplication Table) ing multiplied together will produce it.

#### U

Multiply the given Price by one of those Numbers, and at Product by the other, which will give the Answer.

## XAMPL

14 Ounces of Silver, at 6s. 73d. per oz.

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6s. 73d. 7×2=14.

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181b. of Sugar, at 10th perilb.

27 Quarters of Wheat, at 21. 9s. 6d. per Quar.

30. Yards of German Serge, at 4s. 112d. per Yard.

36 Stone of Wool, at ros. 8d. per st.

45 North Britans, at 21d. each.

50 Moidores, at 27s. each.

56 Yards of Shalloon, at 2s. 71d. per Yard.

64 Firkins of Butter, at 11. 11s. per Fir.

72 Reams of Paper, at 151. 9d. per Ream.

80 Yards of Yorkshire Camblets, at 1134. per Yd.

84 Gallons of Oil, at 91. per Gal.

96 Yards of Indian Dimity, at 15. 103d. per Yd.

99 Yards of Broad Cloth, at 18s. 112d. per Yd.

100 Yards of Cambric, at 11s. 10d. per Yd.

120 Hundred of the best Dutch Pens, at 11. 6d. per h.

132 Deals, at 1s. 10d.

144lb. of Tobacco, at 1s. 73d. per lb.

#### CASE III.

When the given Quantity cannot be produced by the Mitiplication of two fmall Numbers.

### RULE.

Find the nearest Number to it less, by which, multiple as before, then for what is wanting, multiply the Price that Number, and add it to the last Product, and the Towill be the Answer.

#### EXAMPLES.

27. 17 Cwt. of Malaga Raifins, at 11. 4s. 102d. per Cwt. 11. 4s. 10d.

28. 19lb. of fine Hyfon Tea, at 19s. 11td. per lb.

29. 29 Yards of Diaper, at 11. 71d. per yd.

30. 38 Dozen of Mens fine common Hofe, at 21. 171.

31. 47 Yards of flowered Linen, at 5s. 10d. per yd.

32. 58 Ells of Holland, at 10s. 41d. per Ell.

33. 67 cwt. of Tobacco, at 51. 17s. per cwt. 34. 75 Dozen of Soap, at 6s. 4½d. per doz.

35. 86 Yards of green Silk Damask, at 19s. 113d. per y

36. 106 of Vyse's Tutor's Guide, at 31. each.

#### CASE IV.

When the given Quantity consists of 1/4, 1/2, or 1/4.

#### RULE.

Divide the upper Line (the Price of one) by 4 for \(\frac{1}{4}\), for \(\frac{1}{2}\), and for \(\frac{1}{4}\), by 2 first for \(\frac{2}{4}\), then divide that Quot by 2, for \(\frac{1}{4}\); add them to the Product and the Sum will the Answer required.

EXAMPL

#### EXAMPLES.

281b. of Sugar, at 93d. per lb.

Answ. L. 1 2 111=281

3r<sub>1</sub> Tons of Hay, at 3l. 6d. per Ton.
76\frac{3}{2}\text{ dozen of Red Port, at 1l. 12s. 10d. per doz.
121 Barrels of Ale. at 26s. 6\frac{1}{2}d. per bar.

174 Barrels of Ale, at 36s. 64d. per bar. 81 Butts of Beer, at 41. 6s. 7d. per butt.

This Method of finding the Value of any Quantity of ods under 100, at any Price per yd. lb. &c. is of exlent Use to such as buy or sell by Retail.

But for great Quantities, there are other Methods much

ter. (See PRACTICE.)

Yet sometimes it may so happen, that your given Quan-, tho' considerably great, may be wrought by the contial Product of three Numbers, as the following

## EXAMPLES

160 Ounces of fine Gold, at 41. 101. 6d. per oz.

41. 10s. 6d. 10x4x4=160

45 5 4

Anfw. £. 724

112 Bushels of Oats, at 15. 10\frac{3}{4}. per bush.
336 Yards of Dowlas, at 25. 5d. per yd.
350 oz. of Cloves, at 11\frac{3}{4}d. per oz.

271.

Wt.

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Of

## Of WEIGHTS and MEASURES.

(1)	[14lb. 100z. odwts. 21 grs.	1.1
(2)	17 Tons, 17 cwt. 0 qr. 24 lb.	1 1
(3)	14 cwt. ogr. 21 lb. 002. 14 drs.	
(4)	10lb. 63. 43. 19. 17 grs.	. 19
(5)	127 yds. o qr. 3 na.	
(6)	40 Ell Eng. 4 qrs. 2 na.	
(7)	120 lea. 7 fur. 24 p.	
(5) (8) (8) ultiply	147 yds. 2 f. 11 in. 2 b. c.	by
(10) N	46 W. hhds. 47 gal. 7 pts.	( )
(11)	6 tuns, 1 p. 1 hhd. 46 gal. 3 qts.	A
(12)	27 tier. 41 gal. 2 qts. 4 B. hhd. 47 gal. 6 pts.	9 65 70
(13)	10 A. hhds. 17 gal. 3 qts. 1 pt.	1
(14)	12 B. bar. 2 fir. 7. gal. 7 pts.	2 10 8
(15)	140 A. 2 r. 29 p.	14 700
(16)	74 laft, 7 qrs. 4 bu. 1 p.	dely li
(17)	365 D. 5 h. 48 m. 57 fec.	J
	The company of the 10 the property	

#### APPLICATION.

1. What Number taken from the Square of 54, will les

2. Suppose 50 Men take a Prize, and each Man's Sha comes to 1421. what is the Value of the Prize?

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3. What is the Difference, and what the Sum, of fix doz dozen, and half a dozen dozen?

4. A certain Island contains 52 Counties, every County Parishes, every Parish 246 Houses, and every House Persons. I demand the Number of Parishes, House and Persons that are in the whole Island?

5. What difference is there between twice eight and twen and twice twenty eight: As also, between twice

and fifty, and twice fifty-five?

6. By God's Bleffing upon a Merchant's Industry, in Year's Time he found himself possessed of 13000 appeared from his Books, that the last three Years had cleared 8731. a Year; the three precedings

5861. a Year; and before that, but 3641. a Year. The Question is, what was the State of his Fortune at every Year's End that he continued in Trade, and what had he to begin with?

The Remainder of a Division Sum is 20, the Quotient 423; the Divisor is the Sum of both and 19 more; what

then was the Number to be divided?

A Robbery being committed on the Highway, there was affessed on a certain Hundred, in the County of S. the Sum of 373l. 14s. 8d. of which the four Parishes paid 371. 16s. 4d. the four Hamlets 281. 3s. 10d. each, the four Townships nineteen Guineas each, what was the Deficiency?

Suppose that for a Quarter's Rent I pay in Money seven Guineas and fix Pence, and was allowed for small Repair 18s. 6d. for the King's Tax 8s. 9d. what did my

Tenement go at a Year?

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Years

At Leicester, and several other Places, they weigh their Coals by a Machine, in the Nature of a Steel-Yard, Waggon and all; three of these Draughts together amount to 137 cwt. 2 qrs. 10lb. and the Tare or Weight of the Waggon was 13 cwt 1 qr. How many Coals

had the Customer to pay for? A Person dying less his Widow 1780l. and 1250l. to each of his four Children, 30 Guineas a-piece to 15 of his poor Relations, and 150' to Charities; he had been 251 Years in Trade, and at an Average had cleared

126% a Year: What had he to begin with.

A Person dying left his Widow the Use of good. To a Charity he bequeathed 8461. 10s. To each of his three Nephews 1230l. To each of his four Nieces 1050l. To 20 poor House keepers five Guineas each, and 200 Guineas to his Executor: What must he have died possessed of?

A Gentleman gave his Daughter to her Portion a Scrutoire, in which was twelve Drawers, in each of these are fix Divisions, and in each Division there was 100%. a Moidore, and Half a Guinea: What was the young

Lady's Fortune?

Suppose a Gentleman's Income is 500l. per Annum, and he expends daily 191. 11d. what doth he lay up at the Year's End? in all Francisco vania

1 World She is

15. If a Gentleman expendeth daily 11. 12s. 6d. and at the Year's End layeth up 2941. 12s. 6d. I demand his yearly Income?

## QUESTIONS for Exercise at Leisure Hours.

- 16. The Silk Mill at Derby contains 26586 Wheels, and 97746 Movements, which wind off or throw 73726 Yards of Silk every Time the greatWaterWheel, which gives Motion to all the rest, goes about, which is three Times in a Minute. The Question is, how many Yards of Silk may be thrown by this Machine in a Day reckoning ten Hours to a Day's Work? and how many in the Compass of a Year, deducting for Sundays and great Holidays 63 Days; provided no Part of it stands still?
- Piers to support the Arches, every Pier being 60 Fee thick, and some of them were 150 Feet above the Be of the River; they were also 170 Feet asunder: Proposed what was the Width of the River in that Place; and how much did it exceed the Length of Westminster Bridge, which is about 1200 Feet from Shore to Shore and is supported by 11 Piers, making the Number of Arches 12?

of Chesnuts, two by two, three by three, four by sour five by five, or fix by fix, there was still an odd one but when he told them seven by seven, they came even How many had he, (suppose he had the sewest possible.)

19. There are two Numbers, the less is 187, their different 34; required the Square of their Product, ditto of the Sum, and Difference, and the Sum of those Squares?

20. There are two Numbers, the bigger of them is 73 Tim
109; and their Difference 17 Times 28. I dema
their Sum and Product.

21. In the Partition of Lands in an American Settlemer A. had 757 Acres allotted to him, B had 2104 Acre C 16410; D 12881; E 11008; F 9813; H. 1380 and J. 8818 Acres. Now, how many Acres did Settlement contain, fince the Allotments made as alwant 416 Acres of one-fifth of the Whole?

22. How many different Ways can four common Dice of up at one throw? Note, one may come up fixways

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be

1.

2.

23. In a Company S had 31. 17s. 2d. more than T, who had six Guineas less than R, who had within 16s. 8d. as much as W, who was known to have 100 Guineas wanting ten Marks of 131. 4d. each, pray what Money had they among them?

#### DIVISION.

#### EXAMPLES of INTEGERS.

(1)	[ 14076893]	1	4.
(2)	30742145	I	12,
(3)	2410296		84.
(4)	98420649		576.
(5) 0	308763705	4 -	3029.
(6) 5	16221212499 }		46058.
(7) Ä	54799555		127345
(8)	78855994985		3090807.
(9)	1276421427		3700.
(10)	4074964478	1000	827000.
(11)	24769851400		9400.

## COMPOUND DIVISION

CASE Teacheth to divide (by one common Divisor,) either a simple or Compound Number, into any proposed Number of equal Parts, whereof each shall be a Compound Number.

#### CASEIL

When the Divisor doth not exceed 12.

#### R U L E. X

1. Place the Divisor and Dividend as in Integers.

2. Writing their Quotas under each respective Dividend.

3. But if there be a Remainder after dividing any of the Denominations except the leaft, you must find how many of the next lower Denomination it is equal to, by multiplying it by as many of the next less as make one of that, which add to the next (if any) and divide as before.

EXAMPLES

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#### EXAMPLES of MONEY.

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$$10\frac{1}{2}$$
 (2) 7) 267 0 0

6. If 5 Yards of Holland cost 21. 9. 10td. what doth one Yard cost?

7. Bought 3 cwt. of Cheefe, for which I gave 71. 111. 64. at what Rate did I give per cwt?

8. If 10 Dozen of Candles cost 31. 17s. 1d. what costs one Dozen?

9. Suppose I give my Servant 14 Guineas per Year, what does his Monthly Wages come to?

#### CASE II.

When the Divisor exceeds 12, and is such a Number that if any two Figures (in the Multiplication Table) being multiplied together will produce it.

#### RULE.

Divide by its component Parts, as in Sect. 5. Case 4.

## EXAMPLES.

1. Divide 451. 125. 8d. into 16 equal Parts.

$$4\times4=16\left\{\frac{4}{4}\right\}\frac{45l.\ 12s.\ 8d.}{11\ 8\ 2}$$
Answ. £. 2 16  $0\frac{1}{2}$ 

2. Divide 31. 13s. equally amongst 24 Persons.

3. What is Cloth per Yard, when 36 Yards cost 641. 194

4. What is Tobacco per cwt. if 42 cwt. cost 1501. 4s. 6d.

5. Bought 48 Yards of Broad Cloth for 371. 141. 8d. I defire to know at what Rate per Yard?

6. Suppose a Man spends 781. 16s. 8d. in 8 Months Time,

what is that per Week?

7. A Prize of 45671. os. 10d. is to be equally divided amongst 55 Persons; what is each Man's Share?

8. What is Tea per cwt. when 63 cwt. cost 2641. 125.

9. If 7 oz. of Silver cost 18 Guineas, what is it per oz.? 10. Suppose I have for 81 cwt. of Cheese which cost me

1211. 121. 6d. at what Rate did I buy it at per cwt? 11. Divide 1741. 15. 8d. equally amongst 120 Sailors.

#### CASE III.

When the Divisor cannot be produced by the Multiplication of two small Numbers, Divide as in Sect. 4. Case 2.

## EXAMPLES.

12. Divide 2141. 175. equally amongst 17 Persons. 17)2141. 175 (121.

44.00	0.00	160	
34			P.
Rem. 10%.			each.
20			est
17)217(125.			125. 9d. 37
17			
er a <del>wo i</del> ltsey	Rist		25
47			-
34			12%
Rem. 135.			
12			Anfwer,
			F
17)156(94.			Ar
153	(83		1 10
Rem. 3d.			
A CONTRACTOR OF THE RESIDENCE OF THE PARTY O	to an other sections	2 2	

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Years

13. If 26 Tons of Hay coft 83/. 175. what will I Ton coft

14. Divide 4671. amongst 145 People.

The following Examples require three Divisions.

15. I gave 301. 21. for 112 Yards of Cambric, at what Rate did I give per Yard?

16. Divide 10091. equally amongst 350 Persons.

17. Suppose the Clothing of 224 Charity Children comes to 610% 8s. what is the Expence of each?

18. Divide 1426l. equally amongst 640 Persons.

If the given Quantity or Divisor consists of 1, 2, or 1.

#### RULE.

Multiply the given Quantity by 4, adding to the Product 1 for \(\frac{1}{4}\), 2 for \(\frac{1}{2}\), 3 for \(\frac{3}{4}\); and it will give the Divisor, which divide with as before, and the Quotient multiply by 4, will give the Answer.

#### EXAMPLES.

19. Suppose I clear 7000/. equally in 10½ Years, what's my yearly Profit.

10½		<b>(3)</b>	7000		
	· W	21 { 3)	2333	6	8
21 nau	Years.	Half-yearly Gain is	333	6	8 2
		Anfw. L.	666	13	4

20. Suppose I give for 61 Yards of Cambric 121. 121. 114 at what Rate did I buy it at per yard?

qually in 10½ Years, what was his yearly Increase of Fortune?

22. Suppose another to clear 450l. 13s. 112d. equally in & Years, what was his yearly Profit?

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#### Of WEIGHTS and MEASURES.

#### EXAMPLES.

(1)	(8 lb. 1 oz. 15 dwts. 8 grs.	î î	7 2
(2)	24 tuns, 14 cwt. o qr. 14 lb.		3
(3)	17 cwt. 2 qrs. 27 lb. 14 oz. 15 drs.		4
(4)	4 lb. 11 3. 4 3. 2 3. 12 grs.		5
(5)	214 yds. 3 qrs. 2 na.		
(6)	1 120 Ells Eng. 4 qrs.		8.
(7)	12 lea. 2 m. o fur. 26 p.		9
(9) iv (6)	147 yds. 2 f. 11 in- 2 b. c.		10,
(9) 🖫	\$ 24 W. hhds. 57 gal.	> by <	I I
(10) A	ro tuns, I p. 1 hhd. 60 gal. 3 qts.		8
(11)	16 tier. 20 gal. 7 pts.		6
(12)	76 A. hhds. 27 gal.		5
(13)	12 B. hhds. 49 gal. 2 qts.		4
(14)	61 B. bar. 2 ftr. 6 gal.		3-
(15)	140 acres, 2 r. 26 p.		1.5
(16)	60 lasts, 6 grs. 7 bu. 2 pks.		7
(17)	L146 days, 23 h. 24 m. 56 fec-		6

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#### APPLICATION.

An Army of 10000 Men, having plundered a City, took 220000/. what was each Man's Share?

A certain Man intending to go a Journey of 3:36 Miles, and would complete the fame in 12 Days: It is required how many Miles he must travel each Day?

What Number added to the 43d part of 4429 will make the Sum 240?

What Number deducted from the 26th Part of 2262 will leave the 87th part of the same?

What Number, multiplied by 72084, will produce 5190048 exactly?

What Number, divided by 419844, will quote 9494, and leave just a third Part of the Divisor remaining?

The Sum of two Numbers is 360, the less is 144; what is their Difference, Product and larger Quote?

The Spectator's Club of fat People, tho' it confisted but of 15 Persons, is said (No. 9.) to weigh no less than 3 Tons; how much on an equality was that per Man?

Part of 22525, and to the Remainder add the 161
Part of 9696, the Sum will be 1440?

10. What Number, multiplied by 57, will produce in

what 134, multiplied by 71, will do?

as often as it can be found, and fay what the last R mainder exceeds or falls short of 21780?

a half what he allotted his Daughter, and to the you Lady 1383/. less than her Mother; to whom he had queathed four Times what he lest towards the Endoment of Hertford College, Oxon, viz. 1640 Guing I require what he intended for his younger Son, we claimed under the Will half as much as his Mother. Sifter? How much less than 30000/. did the Testator worth, after his Debts and Funeral Expences, being 88/. 10s. were paid?

3. My Purse and Money, quoth Dick, are worth 121. but the Money is worth seven times the Purse: Pr

what was there in it?

14. A young Fellow owed his Guardian 741. 181. 2d. only lance. He paid off 411. 141. 8d. and then declared Sister owed the Gentleman half as much again as his felf: On hearing this, she pays off in Part 131. 121. It and gives out that her Uncle William was not then in Arrear than her Brother and she together. The Unhereupon pays in 241. 7s. 3d. and then the Uncle's Buther, who, by the by, was not the Uncle of those Charm, for 1501. undertakes to set them all clear, has 351. 15s. 5d. he says, to spare: Can that be true

weighed 9 cwt. 3 qrs. 16 lb. for 971. 175. 6d. the Difference in point of Weight, was 1 cwt. 2 qrs. 16 and of Price 81. 135. 3d. Their respective Weight

and Values are required?

Estate consisting of 10000s. in Cash, with 8 Bills of 54s. 10s. 6d. He ordered 30s. to be bestowed upon Burials and his Debts to be paid, amounting to a then his free Estate to be divided in this Manner, The Daughter to have the 9th Part, and the sevens to have equal Shares; what is the Daughter's and also what is the Share of each Son?

QUESTIONS for Exercise at Leisure Hours.

I would plant 2072 Elms, in 14 Rows, 25 Feet asun-

der; how long must the Grove be?

A Brigade of Horse, consisting of 384 Men, is to be formed into a long Square, having 32 Men in Front;

how many Ranks will there be?

Divide 1000 Crowns, betwixt A, B, and C, in such a Manner, that A may have 129 more than B, and B 178 less than C.

Part 250l. give A 37 more than B, and let C have 28

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Six of the Female Cricketers that played lately in the Artillery Ground, fetched in Company, Strokes as follows, viz. A, B, C, D, E, 207. A, C, D, E, F, 213. A, B, D, E, F, 189. A, B, C, E, F, 234. A, B, D, C, F, 222. B, C. D, E, F, 250; how many did they fetch on the other Side, fince these six Persons wanted but fourscore and 13 Notches to decide the Game?

In order to raise a joint Stock of 10000l. L., M., and N together subscribed 8500l. and O. the rest: Now M and N are known together to have set their Hands to 6050l. and N has been heard to say, that he had undertaken for 420l. more that M. What did each Proprietor advance?

There are two Numbers, whose Freduct is 1610, the greater is 46: What is their Sum, Difference, and Quotes, what is the Sum of their Squares, and what

is the Cube of their Difference?

There are other two Numbers, the greater 7050, which divided by the less, quotes 94; what is the Difference of their Squares; and what's the Square of the Product of their Sum and Difference?

What Difference will there be to the Proprietors of an Aqueduct, between doubling an Expence, and halfing

a Profit ?

Part 1500 Acres of Land, give B 72 more than A, and

C 112 more than B.

One of the Smarts in the Accomptant's Office, making his Addresses in an old Lady's Family, who had five fine Daughters; they told him their Father had made a whimucal Will, which might not soon be settled in Chancery, and till then he must restain his Visits. The

YOUNG.

young Gentleman undertook to unravel the Will which imported, That the first four of her Girl's Fortunes were together to make 25000l. the four h 33000l. the three last, with the first, 30000l. the three last, were to make 28000l. and the h last and two first 32000l. Now Sir, if you can make appear what each is to have, and as you like, seemin ly, my third Daughter, Charlotte, I am sure, she make you a good Wise, and you are welcome: Wh was Miss Charlotte's Fortune?

28. By felling 240 Oranges at five for 2d. 120 of whi cost me two a Penny, and the other Half three a Penny, I evidently lose a Groat; pray how comes to

about?

29. A, B, and C play in Concert at Hazard; and at ming up Accompt, it appears that A and B toget brought off 131. 101. B and C together 121. 125. A and C together won 111. 161. 6d. what did to

feverally get?

30. Four Persons advance in Trade as follows, viz. W, and Y, raised 3501. 101. W, X, and Z, 3441. 101.
Y, and Z, made up together 4001. and W, Y, and contribute 3781. 41. In the Conclusion they pa with their joint Property for 450 Guineas; what they gain or lose by their Adventure?

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31. A Tradesman increased his Estate annually a thirds abating 1001. which he usually spent in his Family, at the End of 32 Years, found that his net Estate mounted to 31701. 111. 8d. pray what had he at

fetting?

a Fire-Office. They attend about feven Times in Quarter, and the Absentees Money is always did equally among such as do attend. A and B, on Occasions, never miss, C and D are generally two a Quarter absent, and E only once; at the Paym what had each Man to receive?

by three Boys, and that the first took half what she but returned her back 10; that the second took third, but returned two; lastly, the third took half those she had lest, but returned her one, and

she had got clear she had 12 Apples left; what Number of Apples had she at first?

#### II. REDUCTION.

In this and all the following Rules all great Names are bught into small by Multiplication, on the contrary all all Names into great by Division (6).

#### EXAMPLES of MONEY.

In 1301. how many Shillings, Pence, and Farthings?

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2600 Shillings

12

31200 Pence

4

124800 Farthings

How many Pence, Shillings, and Pounds are in 24000 Farthings?

4)24000

12)6000 Pence

20)500 Shilings

25 f.

In 801. 155. 112d. how many Farthings?
Reduce 16921 Farthings to Pounds.
Reduce 1101. 05. 62d. to Half-Pence.
How many Pounds, &c. are there in 20553 Half-pence?
In 1071. 105. 8d. how many Two-pences?
Reduce 5348 Two-pences to Pounds.
Reduce 61. 175. to Three-pences?
In 2782 Three-pences, how many Pounds, &c?
In 101. 105. 8d. how many Four-pences?
Reduce 3859 Four-pences to Pounds.
How many Six-pences are there in 2001. 175?

14. Reduce

- 14. Reduce 795 Six-pences to Pounds, &c.
- 15. In 21 Guineas, how many Shillings, Pence, and h
- 16. How many Guineas in 24192 Farthings?
  17. In 12 Moidores how many Farthings?
- 18. How many Moidores are there in 3240 Pence?
- 19. In 301. how many Crowns, Half-Crowns, and Pence
- 20. Reduce 2016c Pence to Half-Crowns, Crowns, and
- 21. In 25 Crowns how many Shillings, Groats, and Pena 22. Reduce 25,200 Pence to Groats, Shillings, & Crown
- 23. In 25%. how many Shillings, Crowns, and Pence?
- 24. How many Shillings and Pounds in 80 Crowns?
- 25. How many Crowns, Half-Crowns, and Shillings,
- in 2131. 155. 6d. and of each an equal Number?
- 26. In 120% how many Half-Crowns, Crowns, Groats, a Shillings?
- 27. In 36 Crowns, as many Half Crowns, Shillings, a Groats, how many Pounds?
- 28. Reduce 470l. 171. to Shillings and Moidores?
- 29. Reduce 240 Guineas, to Shillings, Crowns, & Pound
- 30. In 21 Purses, each Purse with 21 Guineas, a Crow and a Moidore in, what Sterling do they contain?

#### COINS.

1. To Reduce Foreign and English Coin to Pounds Staling.

#### RULE.

Multiply the given Number of Pieces, by the Shilling Six-pences, Four-pences, Three-pences, Two-pences, Peno or Half-pence, &c. that are in one Piece, and the Prob will be according, which bring into Pounds Sterl. (by Sect.)

#### EXAMPLES.

- 32. How many Pounds Sterling are there in 1178 Dollar at 41. 3d. each?
  - s. d. 1178 Dollars
  - 4 3 17 Three-pences in one Dollar
  - 4 4120026 Three-pences
  - 20)5c06—2 Three-pences over=6d.

Ans. L. 250 6.6

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. In 470 Pistoles, each 17s. 6d. how many Pounds Sterling?

. How many Pounds are there in 270 Half Guineas?

. In 427 Ducatoons of 6s. 4d. each, how many Pounds Sterling?

. How many Pounds Sterling are there in 2740 Quarter

Guineas?

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Dollar

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r = 64.

33.

To Reduce Pounds Sterling into Foreign and English Coin.

#### RULE.

Reduce the given Pound Sterling, and the given Coin, o one Name, that is, if you can reduce them both into illings, Six-pences, Four-pences, or Three-pences, &c. so; then divide one by the other, and the Quotient will the Answer.

### EXAMPLES.

A Merchant is to pay 2491. 7s. 6d. with how many. Quarter Guineas can be do it?

d. 3 249 7 6 2366

Three pences 4987

Answ. 950 Quarter Guineas.

In 3871. 18s. 4d. how many Florins at 3s. 2d. each?
How many Marks, each 13s. 4d. are in 4961. 18s. 4d.?
With how many Dollars, of 4s. 3d. each, could I pay
2621. 8s. 9d.?
How many Pistoles of 18s. 6d. will be wanted to pay

2471.2

To reduce one Kind of Coin into another Kind of Co

### RIULE.

To reduce both Coins into the same Denomination, then divide one by the other.

#### EXAMPLES.

42. How many Crowns, 5s. 4d. each, are in 474 Pistole 18s. 6d. each?

s. d. 5 4	s. d. 18 6		Pistoles Two-pence	s in one
$\frac{6}{3^2}$ -	6,	5214	1 av 12 av	5 (10 <b>1</b> 0) 5/4 <b>5</b> 00 (
-	Crowns 32 {		Son varifit	va CA su

Anf. 1644 Crowns and 1 Shilling over  $3^{2}$   $\left\{\begin{array}{l} 4 \\ 8 \end{array}\right\}$   $\left\{\begin{array}{l} \frac{52014}{13153-2} \\ -2 \end{array}\right\} = 6$  Two-pend or 15. Over

- 43. How many Guineas are equal in Value to 12401 dores?
- 44. How many Ducatoons, of 5s. 6½d. each, are worth Cobs of 4s. 7d. each?

### Of WEIGHTS and MEASURES.

- 1. In 141b. of Silver, how many Ounces, Penny-wei
- 2. How many lb. of Silver are there in 138240 grs?
- 3. In 19lb. 10 oz. 17 dwts. 22 grs. how many Grains
- 4. Reduce 74342 grs. to Pounds.
- 5. In 4 Ingots of Silver, each weighing 4lb. 6 oz. 2 how many Grains?
- 6. How many Ingots of 6lb. 11 oz. 14 dwts. each, there in 241056 grs.?
- 7. How many lb. of Silver, are there in one Dozen of Deach weighing 25 oz. 15 dwts. and one Dozen of Plates, each weighing 15 oz. 15 dwts. 22 grs.?
- A Gentleman fent 455 oz. 1 dwt. 16 grs. of old Ph his Silversmith, with Orders to make it into the lowing Articles, viz. Punch Bowls each 24 oz. 4

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Tankards each 11 oz. 14 dwts. Tea-pots each 10 oz. 10 dwts. Lamps each 20 oz. 17 dwts. 21 grs. Plates 127 oz. 11 dwts. per Dozen. Spoons 36 oz. 17 dwts. 23 grs. per Dozen. How many of each must he make, supposing for every Dozen of Plates and Spoons he is to make one of each of the other.

. In 41b. 103. 43. 19. 12 grs. how many grs.?

. Reduce 59934 gr. to 3. and lb.

In 6 Tons how many cwts. qrs. and lb.

. How many Tons in 26880 lb?

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02. 4 Tan . Reduce 74 cwt. 2 qrs. 16 lb. 7 dr. to Drams.

. In 29768 oz. how many Hundred Weight?

. Reduce 67lb. 12 oz. 15 dis. to Drams.

In 6 hhds of Tobacco, each weighing net 6 cwt. 3 qrs. 27lb. how many Pounds?

. How many hhds. of Sugar, each weighing 11½ cwt. are there in 12880 lb?

. In 507 cwt. of Lead how many Fother?

Out of 12 cwt. 3 qrs. 12 lb. of Tea, how many Canifters can I fill, each Canifter holding 12lb.

. How many Parcels, each 1262lb. can I have out of an

hhd. of Sugar weighing net 82 cwts.

How many Parcels of 6lb. 8lb. 12lb. and 16lb. can a Grocer have out of two hhds of Tobacco, each weighing net 4 cwt. 3 qr. 24lb. and to have of each a like Number?

To reduce great Pounds into common, multiply by 3, d divide by 2:

To reduce common Pounds to great, multiply by 2, and vide by 3.

. Reduce 24 great Pounds to common Pounds.

. In 120 common Pounds how many great Pounds?

. In 27 yds. 3 qrs. of Cloth, how many Nails?

. How many Yards in 352 Nails?

Reduce 30 Eng. Ells, 4 qrs. 3 na. to Nails.

. In 569 Nails how many Fl. Ells?

. In 14 Pieces of Cloth, each: 24 yds. how many Nails?

. Reduce 24768 Nails to Pieces, each 12 Yards.

In 12 Pieces of Cloth, each containing 20 Flem. Ells, how many Ells English?

. How many Pieces of Cloth, each 24 Ells Flemish, are

there in 227 Yards?

32. In 4 Bales of Cloth, each 12 Pieces, and each Piece: Ells Fl. how many Ells English?

33. In 60 Miles how many Furlongs and Poles?

34. Reduce 12800 Poles to Miles.

35. In 16 Miles, how many Feet, Inches, and Barles

36. Reduce 2280,60 Barley-Corns to Miles.

37. How many Barley-Corns will reach from London Newcastle upon Tyne, being 276 Miles?

38. How many Times doth the Wheel which is 184 Feet Circumference, turn between London and York, bei

39. How many Barley-Corns will reach round the Term trial Globe, which is 360 Degrees, and each Degr

691 Miles?

40. In 64 Acres of Land how many Roods and Poles?

41. Reduce 21760 Poles to Acres.

- vided into Shares of 270 Perches each, how mu Shares doth the Whole contain?
- 43. A Person rents a Farm, which contains 200 Acres Land, but he is to till no more than 96% Acres, desire to know how many Perches there are in the R mainder?

44. In 12 Tierces of Wine, how many Gallons and Pints

45. How many Tierces in 6048 Pints?

46. In 4 hhds. 42 gal. 2 qts. of Wine, how many Quarts

47. How many hhds. of Wine in 5746 Pints?

48. A Gentleman ordered his Butler to bottle off a Pipe red Fort into Quart Bottles, how many Dozen will the faid Pipe fill?

49. In a Tun of Oil how many Quarts, Pints, and Ha

Pints, and of each an equal Number?

and of each a like Number, are there in 1890 G

51. In 12 Barrels of Ale, how many Gallons and Pints?

52. How many Barrels of Ale in 1704 Pints?

53. In 6 bar. 2 fir. 7 gal. of Beer, how many Gallons?

54. In 10 hhds. 42 gal. 4 pts. of Ale, how many Pints?

55. In 2017 qts. of Ale, how many hhds?

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In 12 hhds. of Beer, how many Barrels?

In 18 Barrels of Ale, how many hhds?

In 4 tuns, 1 b. 1 hhd. 49 gal. of Beer, how many hhds. bar. and fir. and of each a like Number?

Reduce 24 qrs. of Wheat to Bushels, Pecks, and Gallons?

In 3360 Gallons of Corn how many Quarters?

How many Quarters and Bushels are there in 42 la. 4 qrs. 7 bu. of Wheat?

In 40 Chaldron of Coals how many bush. and pks?

How many Chaldron of Coals are there in 4762 bush.

. In 47 cha. 30 bush. of Coals, how many Sacks, each 3. Bushels?

How many Chaldron of Coals are there in 6450 Sacks, each 3 Bushels?

How many Minutes are there in a Julian Year ?

Reduce 2073600 Seconds to Days.

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56.

In a Lunar Month, or 27 d. 7 h. 43 m. 5 fec. how many Seconds?

How many Thirds are there in a Solar Year?

In 31557600 Seconds how many Days?

How many Days is it fince the Birth of our Saviour, to

Christmas, 1772, (allowing Julian Years)?

Suppose London was built 1108 Years before the Birth of our Saviour; how many Days is it fince to Christmas, 1772, (allowing the Year as before)?

### 12. The RULE of THREE DIRECT.

Teacheth by three Numbers given to find a fourth in h Proportion to the third as the second is to the first, for ich Reason it is termed the RULE of PROPORTION, as a called the RULE of THREE, from its having three Nums given; and because of its excellent and extensive Use Arithmetic, it is often named the Golden Rule,

To perform which observe the following

### RULE.

State or place the Numbers in such Order, that the first and third Terms be of the same Kind; and the second of the same with the Number required.

G: 3

2. 16

2. If your first and third Terms consist of divers Denominations, reduce them into one, and the second into a lowest Name mentioned.

3. Multiply the second and third Terms together, and wide that Product by the first, the Quotient will be answer to the Question in the same Denomination

Name you left your fecond Term in.

4. If there happens to be a Remainder after the Division reduce it into the next Denomination below the la Quotient, and divide by the same Divisor, the Quotient will be so many of the said next Name; proceed in the Manner to the least Name, and all the Quotients tog ther will be the Answer.

### EXAMPLES.

1. If 3 Yards of Cloth cost 18s. what will be the Value

Tds. s. yds.

If 3: 18:: 17.

3)306

20)102

### Answ. L. 5 2 0

2. If 2lb. of Sugar cost 1s. 612. what will 24lb. of the far

3. If 4lb. of Candles cost 2s. 6d. what will 6 Dozen cost the same Rate?

4. If I cwt. of Cheese cost 26s. what will 40 cwt. of t

Note 1. When the first Term is Unity or 1, reduce the cond Term into whatever Name you see convenient, in Page 60, &c.) which multiplied by the Thirdward give the Answer accordingly, which reduce as may required.

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Suppose I give 71d. for 1 oz. of Coffee, what must I pay for 1 cwt?

Bought 36 oz. of Silver, at the Rate of 3s. 4d. per Ounce, what does the Whole come to?

If I buy 12 Pieces of Cloth, and each Piece contains 30 Yards, at 171. 6d. per Yard; what is the Value of the

Whole?

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Bought 1 cwt. of Tea, for which I was to give at the Rate of 71. 9d. per lb. what doth the Whole stand me in?

Goods by Retail, so as to make a proposed Gain by the Whole; add the Money you would gain to the Sum the whole Goods cost you, and then state your Question as before:

us, if the Whole be fold for the Total of the Cost and Gain, at what Rate must any Part of it be fold for.

A Grocer bought 2 cwt. 1 qr. 14lb. Weight of Cloves, which cost him 34l. 6s. and he would gain 6l. by the Bargain, at what Rate must he sell them at per lb.?

Or if at any Time Damage having happened to any Goods, so as to make a proposed Loss by the Whole, then the said Loss must be subtracted from the Cost, and the Remainder made the second Term as before.

Suppose I have by me 200 Yards of Cambric, which cost me 901. but some Damage having happened to it, I am willing to lose 71. 105. by the Whole; at what Rate then must I sell it per Ell English?

If 9 Dozen Pound of Candles cost 21. 55. what will 41b.

of the same cost?

A Grocer bought 4 hhds. of Sugar, each weighing net 12 cwt. 2 qrs. 24lb. and gave after the Rate of 614. per

lb. I demand what the 4 hhds. came to?

A Merchant at London buys 46 Tuns of Port Wine, which cost him 570l. izs. the Freight thereof from Port to London cost 46l. the Loading and Unloading 6l. Custom 10l. the Charge of the Cellar 4l. and he would gain 360l. by the Bargain.

A Gentleman comes to him and demands the Price of 26 Tuns of the said Wine: Quere, what he must

give ?

14. A Factor bought of a Farmer 12 cwt. 2 qrs. 14lb of Cheefe, and was to give 32s. 6d. per cwt. what me the Farmer receive for his Cheefe?

15. If 1 cwt. of Tea cost 89h 16s. 4d. at what Rate must

be fold at per lb. to lofe by the Whole 1.2%.

16. If in four Months I spend as much as I gain in the how much do I lay by at the Year's End, if I gain en ry 6 Months 1851. 51. 6d.

17. How many Dozen Pair of Gloves, at 16d. per Pair, w pay for 36 Dozen and 8 Pair of Stockings, at 41.6

per Pair ?

18. Bought a Parcel of Cloth at the Rate of 61. 6d. for every Yards, of which I fold a certain Quantity at the Rate of 181. 9d. for every 5 Yards, and gained there as much las 180 Yards cost, now I demand how many Yards I fold?

19. How many Pieces of Holland, each 20 Ells Flem. m I have for 231. 81. at 61. 6d. per Ell English?

I buy for 1021. 16s. 6d. supposing I give at the Rate 4s. 10d. per Ounce?

how many Parcels, each I owt. can I have for 41

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22. A Gentleman having an Estate of 4881. 55. per Ann. is desirous to know how much he may spend daily, that he may lay up 100 Guineas at the Year's End?

23. Suppose a Gentleman has an Estate of 564. 125. per had and he is rated at 35. 9d. per Pound for the Land-To Quere his net yearly Income?

24. Suppose I give 5s. 9d. for 1 oz. of Silver, how may I have a suppose I give 5s. 9d. for 1 oz. 12 dwts. may I have 1 oz. 12 dwts. may I have 1 oz. 12 dwts.

for 2001.

every Pack had 6 Parcels, and each Packs of Clo every Pack had 6 Parcels, and each Parcel contin 10 Pieces, every Piece was 30 Yards; he gave the Rate of 21. 4s. 3d. for 3 Yards; I define to he what the 6 Packs cost him per Yard?

26. If 16 Weeks Pay comes to 141, 161. what is that

Year?

A Butcher goes with 1161. 14s. to Smithfield Market; and buys Cattle at the following Prices, viz. Oxen at 101. each, Cows at 71. each, Calves at 11. 10s. each, Sheep at 19s. each, and of each the fame Number; how many of each Sort will the faid 1161. 14s. buy?

A Person failing in Trade owed me 5601. for which I received only 3741. 10s. 61d. at what Rate dic I receive

per Pound?

The net Proceeds of a hhd. of Barbadoes Sugar, wt. 18 cwt. 3 qrs. 17lb. 7 oz. was 4l. 14s. 6d. the Custom and Fees 2l. 8s. 6d. Freight 1l. 2s. 8d. Factorage 4s. 6d. pray how must I fell it at per cwt. so that I may gain

gl. 101. by the Whole?

A certain Tower projected upon level Ground a Shadow, to the Distance of 63 Yards 1 Foot, when a Staff, 3 Feet in Length, perpendicular erected, cast a Shadow of 6 Feet 4 Inches, from hence the Height of the Tower is required?

Suppose a Person travels 285 Miles in 6 Days, 4 Hours, at what Rate is that per Hour, (allowing 12 Hours to

the Day)?

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Suppose I give 441. 25. for one Pipe of Wine, a what

Rate did I give per Pint?

The Globe of the Earth, under the equinoctial Line, is 360 Degrees in Circumference; and this Body being turned on its own Axis, in the Sydereal Day or 23. Hours, 56 Minutes, at what Rate an Hour are the Inhabitants of Bencoolen, (fituated in the Midst of the torrid Zone) carried from West to East by this Rotation. What is the Value of one Grain of Gold when one Ounce cost 5 Guineas?

If 12 Apples are worth 21 Pears, and 3 Pears cost a Half-penny, what will be the Price of fourscore and

four Apples ?-

It is a Rule in some Parishes to affess the Inhabitants in Proportion to eight-tenths of their Rents: What is the yearly Rent of that House, which pays 81. 105. to the King under this Limitation, at 45. in the Pound? If 19 Yards of Yard-wide Stuff exactly line 14 Yards of Silk of another Breadth, how many Yards of the latter will line 184 Pieces of the former, each Piece holding 281 Yards?

38. In 117 Times 406 Pieces of Coin, worth 3s. 8d. a-pie how many Reas at 20 for 3d. English?

39. A Merchant bought 274 Ells Flemish, of Holland, i 4s. per Ell, and sold it again for 7s. 10d. per Ell El

lish, what did he gain by the Whole?

on the Meridian, will cast a Shadow 98 Feet 6 Incling; I would thereby find the Breadth of a River, the running due E. and W. within 20 Feet 6 Inches ont North Side of the Foot of a Steeple, 300 Feet 8 Indhigh, which at the same Time throws the Extremity its Shadow 30 Feet 9 Inches beyond the Stream?

41. If two Men in three Days will earn 15s, how much

feven Men earn in the same Time?

42. How far will one be able to travel in 9 Days, 8 Ho at the Rate of 12 Miles every 4 Hours, allowing Hours to a travelling Day?

43. What will 1000 Yards of Walling amount to, at

Rate of 4s. 6d. per Rod?

44. A Factor bought 64 Pieces of Holland, which coll 3521. at 35. 6d. per Ell Flemish; I demand how m Yards there were in all, and how many Ells English each Piece?

gain in the same Time, the Interest being at thes

Rate?

46. If 12 Yards of Yard-wide Stuff exactly line 8 Yard Silk of another Breadth; how many Yards of the will line 24 Pieces of the former, each Piece contain 20 Yards?

47. What is the Quarter's Rent of 240 Acres of Land

11, 19s. 6d. per Acre per Annum?

48. A Person owes 1000l. but not being able to pay Whole, compounds with his Creditors for to pay Half a Guinea in the Pound; how much Money

he pay his Creditors?

what Time will it be so at Tyburn, lying due We it at the Distance of a measured Mile, in the Law of 512 Degrees North, where a Degree of Longi measures 37 Miles, 2 Furlongs, 37 Poles, 5 Feet, 6 Inches, known by the diurnal Rotation of the law pass in 4 Minutes Time?

50.

How many Pieces of Holland, each 33 Ells Flem. 1 qr. 2 na. can I have for 1181 171. 72d. when 4 Ells English coft 11. 71. 10d.

I laid out 1001. upon Serges and Shalloons; the total Value of the Shalloons was 60%. and the total Quantity of Serge 236 Yards; also for every two Yards of Serge, I had three of Shalloon; how much Shalloon was there, and what was the Value of one Yard of each Sout?

If 14s, will buy 8lb. of Tobacco, how much will 4l.

195. 11d. buy, at the same Rate?

What will the Carriage of 20 cwt. 2 qrs. 16lb. come to. ne that is at Lincoln lets

at 75. per cwt.?

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Bought a Pipe of Port Wine, for which I gave 251. 45. but it leaked out 12 Gallons; the Remainder I fold at the Rate of 18d. per Quart; what was my Gain or Loss in the Whole?

If 71. 41. 9d. be paid for the Carriage of 20 cwt. 2 gre.

16lb. at what Rate is that per Pound?

How many Bricks, o Inches long, and 4 Inches wide, will floor a Room that is 20 Feet square?

QUESTIONS for Exercise at Leisure Hours.

I am dispatched on a Commission from London to Edinburgh, distant by Computation say 350 Miles, and my Route is fettled at 22 Miles a Day; you, 4 Days after, are fent after me with fresh Orders, and are to travel 32 Miles a Day; whereabout on the Road shall I be over-

taken by you?

In the Year 1 582 Pope Gregory reformed the Julian Kalendar, ordaining, that as the Year is found to confift only of 365 Days, 5 Hours, and about 49 Minutes, in order to prevent the Inconvenience of carrying the Account of Time too forward, by taking the Solar Year at 36¢ Days and 6 Hours full, which in a Series of Years must bring Lady-Day to Michaelmas, that the Christian States for the future should drop three Days in Account every 400 Years; that is to fay, for each of the first three Centuries in that Space of Time, the intercalary Day in February should be omitted, but retained as formerly in the last Century, beginning with the Year 1700, when 10 whole Days were funk at once, by which Artifice the Variation of Time will not, at least for a long Space, be very considerable : secording

of Christ, the New Stile, as it is called, will be Days, as it is now only 11, before the old Stile, w

makes no fuch Allowance?

59. Suppose the Sea Allowance for the common Mentagle. of Beef, and 3lb. of Biscuit a Day, for a Me four People, and that the Price of the first barrelle to the King 21d. per lb. and of the second 12d, was the Ship's Company, that their Meat cost the vernment 12 Guineas per Day; pray what did it for their Bread per Week?

60. A fets out from London for Lincoln, at the very for Time that B at Lincoln fets forward for London, did 135 Miles, at eight Hours End they meet on the Remand it then appeared that A had rode 2½ Miles an Houre than B; at what Rate an Hour did each of the

travel?

61. A can do a Piece of Work in 10 Days, B alone in fet them both about it together, in what Time wi be finished?

62. B and C together can build a Boat in 18 Days; the Affiliance of A they can do it in 11 Days; in w

Time would A do it by himself?

63. In some Parishes in the Country, they take off 3l.
Year in 17 from the Rents in assessing the Farms; will the Landlord receive net out of a Farm of 140
Year, in those Places, when the King's Tax is, as n

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4s, in the Pound?

64. A Tradesman begins the World with 1000s. and in that he can gain 1000s. in 5 Years by Land Tradene, and that he can gain 1000s. in 8 Years by Trade alone; and likewise that he spends 1000s. in Years by Gaming; how long will his Estate last, if follows all three?

65. If I leave Exeter at 10 o'Clock on Tuesday Monfor London, and ride at the Rate of 2 Miles an Hwithout Intermission; you set out of London for Exat 6 the same Evening, and ride three Miles an H constantly: The Question is, whereabout on the Hyou and I shall meet, if the Distance of the two C be 170 Miles?

66. If the Sun moves every Day one Degree, and the M thireen, and at a certain Time the Sun be at the

ginning of Cancer, and in three Days after the Moon in the beginning of Aries, the Place of their next following Conjunction is required?

As I was beating on the Forest Grounds,
Up starts a Hare before my two Grey-hounds:
The Dogs, being light of Foot, did fairly run
Unto her fifteen Rods, just twenty-one.
The Distance that she started up before
Was four-score, sixteen Rods just, and no more:
Now this I'd have you unto me declare,
How far they run before they caught the Hare?

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to move about 1150 Feet in one Second of Time.

How long after firing the Warning Gun in Hyde-Park may the same be heard at Highgate, taking the Distance at 53 Miles?

If I see the Flash of a Piece of Ordnance, fired by a Vessel in Distress at Sea, which happens we will suppose nearly at the Instant of its going off, and hear the Report a Minute and three Seconds afterwards, how far is she off, reckoning for the Passage of Sound as before?

### Of the LEAVERS.

wherein the Weights, Props, or moving Powers, may be differently applied to the Vectis, or inflexible Bar, in order to effect Mechanical Operations in a convenient Manner.

### For the first Order see Page 77.

Of the fecond and third Order of LEAVERS.

Mechanics, a Leaver of the second Order is, where the Power acts at one End, the Prop fixed directly at the other, and the Weight somewhere between them.

this Order of Leavers, their Force is in a contra Pro-

H

In a Leaver of the third Order, the Prop is planted one End of the Bar, the Weight at the other En and the moving Force somewhere between.

70. If a Leaver be 100 Inches long, what Weight, lying 7½ Inches from the End, resting on a Pavement, in be moved with the Force of 168lb. listing at the oil End of the Leaver?

Inches	Inch. 1b. Inch.
100 73	If $7\frac{1}{2}$ : 168 :: $92\frac{1}{4}$
	How the specifical real reduce the
92½ longest End	U 5 168
	Answer, 15)31080(2072)

71. A Water-wheel turns a Crank, working three Purrods, fixed just fix Feet from the Joint or Pin; which their several Leavers, each nine Feet in Lenguage fastened, for the Sake of the intended Motion, one End, the Suckers of the Pumps being worked the other, shews them to be Leavers of the third der: Now I would know what the Length of the Sm in each of the Barrels will be if the Crank be made play just nine Inches round its Centre?

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72. With what Force ought that Water wheel to be dri which, circumstanced as in the last Question, raises the Cubic Feet of Water at every Revolution of the Whater at every Rev

Friction of the Machine rejected?

### Motion of Bodies with their Velocities.

put in Motion, be equal, the Forces where they are moved will be in Proportion to their vicities.

2. If the Velocities of these Bodies be equal, their so will be directly as the Quantities of Matter conta

in them.

3. If both the Quantities of Matter and the Velocitic unequal, the Forces with which the Bodies are need, will be in a Proportion compounded of Quantities.

Quantities of Matter they contain, and of the Velo-

cities wherewith they move.

There are two Bodies, the one contains 25 Times the Matter of the other (or 25 Times heavier) but the lesser moves with 1000 Times the Swiftness of the greater; in what Proportion are the Forces by which they are moved?

### If 25 : 1000 : : 1

25)1000(40, the less is moved with a

Force fo much greater than the other.

There are two Bodies, one of which weighs toolb the other 60lb, but the lesser Body is impelled by a Force eight Times greater than the other, the Proportion of the Velocities, wherewith these Bodies move, is required?

There are two Bodies, the greater contains 8 Times the Quantity of the Matter in the less, and is moved with a Force 48 Times greater; the Ratio of the Volocity of

of these two Bodies is required?

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r. In comparing the Motions of Bodies, if their Velocities be equal, the Spaces described by them are in direct Proportion of the Times in which they are described?

2. If the Times be equal, then the Spaces described will

be as their Velocities.

3. If the Times and the Velocities be unequal, the Spaces will be in a Proportion compounded of the Times and Velocities.

There are two Bodies, one of which moves 40 Times swifter than the other, but the swifter Body has moved but one Minute, whereas the other has been in Motion two Hours: the Ratio of the Spaces described by these

two Bodies is required?

Suppose one Body to move 30 Times swifter than another; as also the swifter to move 12 Minutes, the other only 1, what Difference will there be between the Spaces by them described, supposing the last has moved 60 Inches?

There are two Bodies, one whereof has described 50 Miles, the other only 5, but the first hath moved with 5 Times the Velocity of the second; what is the Ratio

H 2

then of the Times they have been describing the Spaces?

### 13. RECIPROCAL PROPORTION

O R,

### The RULE of THREE INVERSE.

Reciprocal Proportion is, when of four Numbers, third beareth the same Ratio to the first as the second to the fourth; therefore the less the third term is in respect to the first; the greater will the fourth Term be in respect to the second.

### RULE.

Multiply the first and second Terms together, and distheir Product by the third Term, the Quotient will be Answer.

### EXAMPLES.

1. If 48 Men can perform a Piece of Work in 12 Days, I many Men can do the same in 72 Days?

D. M. D.

If 12: 48:: 72

 $72 \begin{cases} 8 \\ 9 \end{cases} \frac{576}{72}$ 

### Anfw. 8 Men.

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2. How much in Length, that is four Inches broad, make a Foot square?

3. Suppose I lend my Friend 500l. for six Months, (all ing the Month to be 30 Days) afterwards he we requite my Kindness by lending me 220l. required Time I must have it, to require my former Kindness.

4. A Garrison being besieged, has three Months Provi in it, at the Rate of 14 Ounces per Day each N but being informed that it cannot be relieved til End of 8 Months: How many Ounces per Day must each Man have, that the said Provision may last that Time?

If, when the Price of a Bushel of Wheat is 4s. 6d. the Penny Loaf weighs 12 oz. what must the Penny Loaf weigh, when the said Bushel is worth but 3s.?

Suppose 275 Yards of Cloth, which is 5 qrs. wide, make Coats for 130 Men; how many Yards of Shalloon, of 3 qrs. wide, will line the said Coats?

In what Time will 6001, gain 501. Interest, when 801.

does it in 15 Years?

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Suppose 2001 would defray the Expences of 10 Men for 43 Weeks and 5 Days; how long would fix Men be in spending the same Sum?

How many Yards of Paper, that is 3 qrs. wide, will hang a Room that is 30 Feet long and 24 Feet wide? A Garrison, consisting of 1500 Men, being besieged, have Provisions only for 3 Months, but it being necessary they should hold out 5 Months, how many Men must depart, that the said Provisions may serve that Time?

There is a Veffel, having a Cock, which will empty it in 6 Hours: I demand how many Cocks of the fame Capacity t there must be to empty the said Vessel in 15. Minutes?

### A LEAVER of the First ORDER:

Leaver of the first Order hath the Power at one of its and, the Weight to be raised is put at the other, and he Fulcrum or Prop somewhere between them.

this Order the Power applied at one End will be reciprocally proportional to the Distances of those Ends from the Fulcrum, or Point supported; or in the Steel-Yards, as the Distance of the Weight from the Point of Suspension.

### QUESTIONS for Exercise at Leisure Hours.

What Weight will a Fellow he able to raise, who prefses with the Force of a Hundred and half on the End of an equipoised Hand spike 100 Inches long, which is to

H 3

meet.

meet with a convenient Prop exactly 71 Inches about the other End of the Machine?

In. In. Ib. In. C. 100 If  $92\frac{1}{2}$ : 168: :  $7\frac{1}{2}$ : 2072=18 $\frac{1}{2}$ 

921 the Answer.

13. What Weight, hung at 70 Inches Distance from the Fulcrum of a Steelyard, will equipoise a hhd. of To bacco weighing 9½ cwt. freely suspended at two Inches Distance on the contrary Side.

### MOTION of BODIES, with their VELOCITIES.

In comparing the Motion of Bodies, the Ratio or Proportion between their Velocities will be compounded the direct Ratio of the Forces wherewith they a moved, and the reciprocal of their Quantities

Marter they contain.

The battering Ram of Vespasian weighed, support 100000lb. and was moved, let us admit, with such Velocity, by Strength of Hands, as to pass through a Feet in one Second of Time, and this was found sufficient to demolish the Walls of Jerusalem; with what Velocity must a Bullet that weighs but 30lb. be moved in order to do the same execution?

as to fend it 100 Feet in a Second; with what Velocity would a Body of 8lb. move, if it were impelled by

fame Force?

### 14. CONTRACTIONS in the RULE of THREE.

This being confidered, you may oftentimes perform to Work much shorter than by the general Rule.

### CONTRACTION I.

Divide the third Term by the first, multiply that Quotit by the second, and their Product will be the Answer.

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### EXAMPLES.

If four Yards of Broad Cloth cost 31. 175. 6d. what will a Piece, containing 28 Yards, come to, at the same Rate?

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If 3 Chests of Tea, each 3 cwt. cost 111. 131. what must

### CONTRACTION II.

Divide the second Term by the first, multiply that Quo-

### EXAMPLES.

Suppose I give 781. for 26 cwt. of Cheese, what must be given for 156 cwt. of the same?

If for 3lb. of Tea-I give 18s. what is the Value of 1cwt.

of the same?

### CONTRACTION III.

iwide the first Term by the second, and divide the third.
by that Quotient, which will give the Answer.

### EXAMPLES.

Stuff, 61. what must be given for 64 Yards, at the same

f I give 12s, for 24lb. of Sugar, what must be given for 12 cwt. of the same?

### CONTRACTION IV.

ivide the first Term by the third, divide the second by Quotient, and the last Quotient will be the Answer.

### EXAMPLES.

uppose I give for 3 Pieces of Broad Cloth, each 24 Yards, 641. 14s. what must be given for eight Yards of the same?

8. If

8. If for 6 Parcels of Tea, each 3lb. I give 121. 191. who must I give for 6lb. of the same, at that Rate?

### CONTRACTION V.

Divide the first Term by the third, multiply the second by that Quotient, and the Product will be the Answer.

### BXAMPLES.

9. How much in Length, that is 3 Inches broad will m

ny Hundred can I have carried 64 Miles for the fa Money?

### 15. COMPOUND PROPORTIO

OR,

### The RULE of FIVE.

SU

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fo

Is so called, from its having five Numbers or Terms give find a fixth, which if the Proportion is direct, the first must bear such a Proportion to the fourth and sas the third bears to the first and second. But if Proportion is inverse, then the fixth Term must bear such a proportion to the fourth and fifth, as the first bears to second and third, or as the second bears to the first third.

The three first Terms are a Supposition, the two li

### RULE

1. Let the principal Cause of Gain, Loss, or Action, be put in the first Place.

2. Let that which denotes Time, Distance of Place, &c in the second Place, and the remaining one in the Place.

3. Place the other two Terms which move the Question derneath those of the same Name.

4. If the Blank or Term fought fall under the third To multiply the two first Terms together for a Divisor.

the three last for a Dividend, the Quotient arising from them will be the Answer or fixth Term. If the Blank fall under the first or second Term, multiply the third and fourth Terms together for a Divisor, and the other three for a Dividend, the Quotient arising from them will be the Answer.

### PROOF.

By two statings in the single Rules of Three.

16 Men can mow 72 Acres of Grass in 12 Days, how
many Men can mow 120 Acres in 4 Days?

D. A. D. A.

M. D. A.

String Proof

If 12: 72:: 4:24

A. M. A.

If 24: 6:: 120: 30 Mem.

If  $\frac{1}{2}$  = 288 the Divisor  $\frac{1}{2}$  per Rule 5.

En 288)8640=30 Men, the Answer.

Suppose 2 Bushels of Wheat will be sufficient for a Family of 6 Persons 12 Days; how many Bushels will serve

36 Persons 4 Days?

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Suppose the Salary of 6 Persons for 21 Weeks is 120% what will be the Salary of 14 Persons for 46 Weeks? If for the Carriage of 40 cwt. 100 Miles, I give 91. 55. what Weight can I have carried 125 Miles for 701. 105. 34d. at the same Rate?

An Usurer put out 1201. to receive Interest for the same; but when it had continued 9 Months, he took it up, and received for the Principal and Interest 1251. 8s. I demand at what Rate per Cent. per Annum he received?

What is the Interest of 2591. 131. 5d. for 20 Weeks, at

51. per Cent. per Annum?

f a Quantity of Provisions serve 1400 Men 20 Weeks, at the Rate of 14 Ounces per Day each Man; how many Men will the same Provisions maintain for 8 Months, at the Rate of 8 Ounces per Day each?

Suppose 8 Men earn 51. in 5 Days; how many Men will

earn 10 Guineas in 12 Days?

suppose 140/. would defray the Expences of five Men for twenty-four Weeks and four Days; how long would

would twelve Men be in spending 2001. at the Rate?

Year and Quarter's Time?

for a Week, how many Poor belonged to that he which, when Coals were 36s. per Chaldron, had to pay in 6 Weeks on that Account?

### 16. COMPOUND PROPORTIO

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### The RULE of THREE REPEATE

All Questions in the foregoing Rule of Five (as been before observed) may be resolved by two Open in the Rule of Three repeated; but there are some tions that cannot be solved by the Rule given there, in stating, yet may be answered by two or more Stating the Rule of Three repeated.

### QUESTIONS for Exercise at Leisure Hours

Fathoms about. They begin to go round it bot fame Way at the same Instant of Time; A goes it es in 2 Minutes, and B 17 in 3: The Question is, many Times will they surround this Wood, before nimbler overtakes the flower?

Min. Toifes Min. Toifes.

Lison

First, If 2: 11: 13: 16 A goes, while B goes 17.

Then 17—16 = 1 T. B gains of A in going 17 T. B.

Again, 1: 17: 1 17 Times round gone by A. and
by B. the Answer.

2. If a Leaver, 40 effective Inches long, will, by and Power thrown successively thereon, in 13 Hours I Weight 104 Feet, in what Time will two others ers, each 18 effective Inches long, raise an equal W 73 Feet; the Force of strait Leavers being in Proportion of their Lengths?

Weight of 1½lb. laid on the Shoulder of a Man, is no greater Burthen to him than its absolute Weight or 24 Ounces; what Difference will he feel between the said Weight applied near his Elbow, at 12 Inches from the Shoulder, and in the Palm of his Hand, 28 Inches therefrom; and how much more must his Muscles then draw to support it at right Angles; that is, have his

Arm extended right out?

shafts whereof were settled at 11 Feet between the Axle-Tree, whereon the principal Bearing is, and the Backband, by Means of which the Weight is partly thrown upon the Horse; a Dispute arose whereabout on the Shafts the Centre of the Body of this Machine should be fixed. The Coach-maker advised this to be done at 30 Inches from the Axle: others were of Opinion, that at 24 it would be a sufficient Incumbrance to the Horse. Now, admitting the two Passengers, with their Baggage, ordinarily to weigh 2 cwt. a-piece, and the Body of the Vehicle to be about 70lb more; pray what will the Beast, in both those Cases, be made to bear more than his Harness?

appose a Person to travel 152 Miles in 7 Days, when the Days are 12 Hours long; how many Days will he be in travelling 576 Miles, when the Days are 16 Hours

long?

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ly Water-Tub holds 147 Gallons; the Pipe usually brings in 14 Gallons in 9 Minutes; the Tap discharges, at a Medium, 40 Gallons in 31 Minutes. Supposing these both carelessly to be left open, and the Water to be turned at 2 in the Morning; the Servant at 5, finding the Water running, shuts the Tap, and is solicitous in what Time the Tub will be filled after this Accident, in case the Water continues slowing from the Main.

the Scavenger's Rate at 1\frac{1}{2}d. in the Pound comes to 6s. 7\frac{1}{2}d. where they ordinarily affels \frac{4}{3} of the Rent; what will the King's Tax for that House be, at 4s. in the

Pound, rated at the full Rent?

when Port Wine is 17 Guineas the Hogshead, a Company of 45 People will spend 201. therein, in a certain Time; what is Wine a Pipe, when 13 Persons more,

will

will spend 63h in twice the Time, drinking with a Moderation?

9. There is an Island 73 Miles round, and three Foot all start together, to travel the same Way about it travels 5 Miles a Day, B 8, and C 10; when will

all come together again?

ro. A certain Man hires a Labourer on this Condition, for every Day he worked he should receive 1s. but every Day he was idle he should be mulcted 8d. a 390 Days were past, neither of them were indebted one another; how many Days did he work, and many Days was he idle?

the 11th of December to the 10th of May follow B, on another Occasion, let A have 100 Marks, s September the 3d to Christmas following: Quere, l long ought the Person obliged to let his Friend use

fully to retaliate the Favour?

that he should have zod. for every Day he worked, forfeit 10d. for every Day he idled; at last he read 2l. 1s. 8d. for his Labour; how many Days did work, and how many was he idle?

### 17. PRACTICE.

So called from the general Use it is of to all Personst

All Questions in the Rule of Three, where the first To

is Unity or one, may be performed by this Rule.

Which is by taking Aliquot or even Parts, by w

Means many tedious Reductions may be avoided.

But as there are a great Variety of such Parts, so me therefore are the Ways of applying them, that it we be an endless Task to give all the easy Methods of Option adapted to particular Cases; so I shall only give General Rules, with a sufficient Number of Example each.

In order to perform this Rule expeditiously, it will necessary that the Learner get by Heart the following

### T A B L E 8.

TaPound OfaSh. Of a Ton Of an Hund. Of a Quar. of an G.

8=
$$\frac{1}{12}$$
0= $\frac{1}{10}$ 
1= $\frac{1}{2}$ 
1= $\frac{1}{12}$ 
1= $\frac{1}{12}$ 
1= $\frac{1}{12}$ 
1= $\frac{1}{12}$ 
2= $\frac{1}{10}$ 
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2 =  $\frac{1}{10}$ 
2 =  $\frac{1}{10}$ 
3 =  $\frac{1}{4}$ 
4 =  $\frac{1}{5}$ 
0 =  $\frac{1}{5}$ 
1 =  $\frac{1}{4}$ 
1 =  $\frac{1}{5}$ 
1 =  $\frac{1}{4}$ 
2 =  $\frac{1}{5}$ 
3 =  $\frac{1}{4}$ 
4 =  $\frac{1}{5}$ 
1 =  $\frac{1}{4}$ 
3 =  $\frac{1}{4}$ 
4 =  $\frac{1}{5}$ 
5 =  $\frac{1}{4}$ 
1 =  $\frac{1}{5}$ 
1 =  $\frac{1}{5}$ 
1 =  $\frac{1}{5}$ 

#### CASE I.

When the Price is less than a Penny.

### RULE.

Divide by the Aliquot Parts that are in a Penny, then by and 20, which will give the Answer.

# EXAMPLES.

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2107 at \$d. 2. 1470 at \$d. 3. 1276 yds. at \$d. per yd.

### CASE II.

When the Price is less than a Shilling.

### RULE.

Take the Aliquot Part or Parts that are in a Shilling add them together, and the Sum will be the Answer a Shillings, &c. which, divided by 20 as before, will gin £. &c.

### EXAMPLES.

6	1 2	1609	at 1144.
3		804	6
		402	3
2	3	268	2
34	4	100	63
	2,0	157,5	54

Anfw. L. 78 15 54

4.	1762 at 1d.	5.	1400	at 114d.	6.	2462	at 11/2d. ]	per
7.	1041 at 13d.	8.	2490	at 2d.	9.	2408	at 21/4d.	
10.	640 at 2½d.	11.	1740	at $2\frac{3}{4}d$ .	12.	746	at 3d.	
13.	1417 at 34d.	14.	3091	at 31/d.	15.	214	at $3\frac{3}{4}d$ .	
16.	2000 at 4d.	17.	569	at 41/4.	18.	1246	at $4^{\frac{1}{2}}d$ .	
19.	1426 at 43d.	20.	2740	at 5d.	21.	2147	at 5\frac{1}{4}d.	
22.	$674 \text{ at } 5\frac{1}{2}d.$	23.	1746	at 53d.	24.	1741	at 6d.	
25.	2142 at 64d.	26.	1940	at 61d.	27.	1746	at 63d.	101
28.	1000 at 7d.	29.	1656	at 7 4d.	30.	1420	at 7½d.	
31.	674 at 73d.	32.	2170	at 8d.	33.	1700	at 84d.	
34.	1765 at 8½d.	35.	749	at 83d.	36.	1417	at od.	

37. 2373 at  $9\frac{1}{4}d$ . 38. 1476 at  $9\frac{1}{2}d$ . 39. 1760 at  $9\frac{3}{4}d$ .

40. 6000 at 10d. 41. 4652 at  $10\frac{1}{4}d$ . 42. 2476 at  $10\frac{1}{2}d$ .

43. 2176 at  $10\frac{3}{4}d$ . 44. 1276 at 11d. 45. 2142 at  $11\frac{1}{4}d$ .

46. 4760 at  $11\frac{1}{2}d$ . 47. 640 at  $10\frac{1}{4}d$ .

#### CASE III.

When the Price is more than a Shilling, but less than two.

#### RULE.

Take the Part or Parts, with so much of the given Price, s is more than a Shilling, (as in the last Rule,) which add the given Quantity, and the Sum will be the Answer in hillings, &c. which divided by 20, will give f.

lote, The Method of performing this Case, being so little different from the last, I shall only give a few Examples, which by proper Instructions from the Tutor will suffice.

### EXAMPLES.

d.  $\begin{bmatrix} 6 \\ \frac{1}{2} \end{bmatrix}$  1074 lb. at 15. 102d.  $\begin{bmatrix} 537 \\ 358 \\ \frac{1}{8} \end{bmatrix}$  67  $\begin{bmatrix} \frac{1}{2} \\ 20 \end{bmatrix}$  203,6  $\begin{bmatrix} \frac{1}{2} \\ \frac{1}{2} \end{bmatrix}$ 

Answ. L. 101 16 11

9. 2140 at 15 1d. 50. 1749 oz. at 15. 112d. per Ounce.

1. 2140 at 1s. 5d. 52. 1453 at 1s. 71d.

3. 1614 at 11. 10d. 54. 2647 at 15. 113d.

test mand sink the

### CASE IV.

When the Price confifts of any even Number of Shilling under 20.

#### RULE.

Multiply the given Quantity by Half the Price, doubling the first Figure of the Product for Shillings, and the rest the Product will be f.

## EXAMPLES.

276 Ells, at 18s. per Ell.

9

An. f. 248 0 8

55. 2476 at 21. 56. 1476 at 41. 57. 276 lb. at 61, perl

58. 2100 at 8s. 59. 274 at 10s. 60. 674 at 124

61. 2680 at 141. 62. 267 at 161. 63. 1267 at 18

#### CASE V.

When the Price is any odd Number of Shillings under

### RULE.

Multiply the given Quantity by the Price, and the Price will be the Answer in Shillings, which divided by will give f.

EXAMPLES.

268 lb. at 19s. per lb.

19

2,0)509,2

254 12 - 254 12 - 2

### 65. 2460 Ells at 31. per Ell

66. 2174 at 75. 67. 1427 at 95.

68. 647 at 116

will juffice.

69. 267 at 135. 70. 274 at 175.

71. 1260 at 19

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#### CASE VI.

When the Price is Shillings, or Shillings and Pence, and y an Aliquot Part of a Pound.

### RULE.

livide by the Aliquot Part, and the Quotient will be the

### EXAMPLES.

s. d.

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114

at 19

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6 8. is 1/3 1471 yds. at 6s. 8d. per yd.

Answ. L. 490 6 8

2420 at 4s. 73. 1764 at 5s. 74. 4762 at 1s. 8d. per yd.

467 at 2s. 6d. 76. 1760 at 3s. 4d. 77. 176 at 6s. 8d.

#### CASE VII.

Then the Price is Shillings, Pence, and the Shillings and the be not an Aliquot Part of a Pound.

### RULE.

ultiply the given Quantity by the Shillings, and take s for the Pence, &c. (as in Case II.) add them together, the Sum will be the Answer in Shillings, which, dividing y 20, will give f.

### EXAMPLES.

	$\frac{d}{6}\left \frac{1}{2}\right $	2470 lb. at 115. 8½d	per lb
	2 3 1 4	27170 1235 411 8 102 11	
1	20	2891,9 7	

Answ. L. 1445 19 4

I 3

78.

### Practice.

78. 1420 at 3s. 3d. 79. 427 at 5s. 9d. per yard.

80. 402 at 101. 83d. 81. 174 at 171. 92d.

82. 273 at 19s. 43d. 83. 260 at 14s. 114d.

# CASE VIII. When the Price is Pounds only.

#### RULE.

Multiply the given Quantity by the Price, and the h duct will be the Answer.

240 Tons at 7h per Ton.

7

### An. £. 1680

86. 100 at 3l, 87. 142 at 42l,

### CASE IX.

When the Price is Pounds and Shillings.

### RULE.

Multiply the Quantity given by the Pounds, as in the Case, and proceed with the Shillings, if they are even, in Case IV, but if odd, take aliquot Parts, add them to ther, the Sum will be the Answer; or reduce the given Price to Shillings, by which multiply the given Quantitand divide by 20, will give the Answer.

		E	X	A	1	M	P		L	E	3	S.		
10	1 2	I Ca	at	41.	17		OI	th!	us,	1	64	at	41.	175.
		4				*		7			97		2	0
		656								11	48		9	- 7
5	1 2	82					100	o secretari	1	47	6			
2	1 5	16	8				1	,0	)14	99	8,0			175. 0 - 7

Anf. L. 795 8 0

Apf. L. 795 8 as before.

9

ed giv 649 at 21. 6s. 89. 526 at 71. 16s. 90. 142 at 11. 17s.

164 at 241. 19s. 92. 271 at 51. 7s. 93. 604 at 201. 9s.

94. 914 at 101. 15s. 95. 737 at 11. 14s.

### CASE X.

Vhen the Price is Pounds, Shillings, and Pence, and the lings and Pence be an aliquot Part of a Pound.

### RULE.

Iultiply the given Quantity by the Pounds, as in the Rule; and take Parts for the Shillings and Pence, as Case VI, add them together, and the Sum will be the wer.

### EXAMPLES.

s. d. 2 6 ½ 247 at 31. 2s. 6d. 3
741
30 17 6

An. £. 771 17 6

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96. 274 at 7l. 6s. 8d. 97. 120 at 12l. 3s. 4d.

99. 97 at 9l 1s. 8d. 98. 512 at 42l. 5s.

### CASE XI.

When the Price is Pounds, Shillings, once, and Fargs, and the Shillings and Pence be not an aliquot Part Pound.

### RULE.

educe the Pounds and Shillings into Shillings, multiply given Quantity by the Shillings, as in Case IX, take is for the Pence and Farthings as in Case II.

Note,

78. 1420 at 31. 3d.

79. 427 at 55. 9d. per yard.

80. 402 at 101. 8\frac{3}{4}d.

81. 174 at 175. 91d.

82. 273 at 195. 43d.

83. 260 at 14s. 114d.

# CASE VIII. When the Price is Pounds only.

#### RULE.

Multiply the given Quantity by the Price, and the h duct will be the Answer.

240 Tons at 7h per Ton.

7

### An. £. 1680

84. 120 at 41.

85. 96 at 171. per cwt.

9

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86. 100 at 31,

87. 142 at 421.

### CASE IX.

When the Price is Pounds and Shillings.

### R U L E.

Multiply the Quantity given by the Pounds, as in the Case, and proceed with the Shillings, if they are even in Case IV, but if odd, take aliquot Parts, add them to ther, the Sum will be the Answer; or reduce the given Price to Shillings, by which multiply the given Quantitand divide by 20, will give the Answer.

	•	EX	A	M	P	L	E	s.	41. 175. 20 — 97
10	1 2	I at	41. 1	73.	or th	us,	164	at	41. 175.
		4		7	7		97		20
1		6,6			3	II	148	-	07
5	1 2	82				12	76		91
	1	41					38.5		
2	3	1 16 8			2,0	0)15	90,8		

Anf. L. 795 8 0

Apf. £. 795 8 as before.

649 at 21. 6s. 89. 526 at 71. 16s. 90. 142 at 11. 17s.

164 at 241. 19s. 92. 271 at 51. 7s. 93. 604 at 201. 9s.

94. 914 at 101. 15s. 95. 737 at 11. 14s.

### CASE X.

Vhen the Price is Pounds, Shillings, and Pence, and the lings and Pence be an aliquot Part of a Pound.

### RULE.

Iultiply the given Quantity by the Pounds, as in the Rule; and take Parts for the Shillings and Pence, as Case VI, add them together, and the Sum will be the wer.

#### EXAMPLES.

s. d. 2 6 ½ 247 at 31. 2s. 6d.

> 741 30 17 6

An. £. 771 17 6

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96. 274 at 7l. 6s. 8d. 97. 120 at 12l. 3s. 4d.
99. 97 at 9l 1s. 8d. 98. 512 at 42l. 5s.

### CASE XI.

When the Price is Pounds, Shillings, Ince, and Fargs, and the Shillings and Pence be not an aliquot Part Pound.

### RULE.

educe the Pounds and Shillings into Shillings, multiply given Quantity by the Shillings, as in Case IX, take s for the Pence and Farthings as in Case II.

Note,

Note, When the given Quantity doth not exceed 100, ceed as in Sect IX.

### EXAMPLES.

6	72	267 cwt. :	at 21. 121. 63d. per o	ewt.
4	138	534 1335 133 6 16 8 1	at 21. 12s. 63d. per ( 20 52s.	2 (7 16 2 (2 )
		14034 21	ni en len ku k Ni en len bro Len en en en len b	

An. £. 701 14 21

100. 1472 at 4l. 6s. 7½d.	101. 279 at 61. 11s. 94
102. 1420 at 19l. 14s. 11ad.	103. 2074 at 11. 171.5
104. 27 at 4l. 11s. 83d.	105. 64 at 121. 131. 7

### CASE XII.

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When the Price and Quantity given are of feveral De

### RULE.

Multiply the Price of one, by the Quantity given, take Parts for Quarters, Pounds, &c. add them together, the Sum will be the Answer.

### EXAMPLES.

Bought 7 cwt. 3 qrs. 18 lb. of Sugar, at 17s. 6d. per of what comes it to?

qrs.	1.	s. 17	d. 6 7
ı ar. 🗜	6	2 8	6
1 qr. 1/2 16 lb. 1/7 2 lb. 1/8	0	4 2	41
1	0	0	3

Anfw. L. 6 18 53

Sold 10 cwt. 3 qrs. 14lb. of Cheefe, at 2l. 11s. 102d. per cwt. what doth the Whole come to?

Bought Tobacco at 31. 175. 41d. per cwt. what is the

Worth of 72 cwt. 3 grs. 19 lb.

De

n,

er c

Bought 12 cwt. 1 qr. 17 lb. of Hops, at 41. 4s. 4d. per cwt. what do they stand me in?

Sold 23 cwt, 18 lb. of Sugar, at 41. 14s. 12d. per cwt. what comes it to?

What comes 94 cwt. 27 lb. of Cloves to, at 61, 191.

Sold 16 cwt. 2 qrs. of Tallow, at 2h 6s. 11d. per cwt.

what comes it to?
Sold 48 cwt. 2 qrs. 7 lb. of fine Hyson Tea, at 741.
16s. 6d. per cwt. what must I receive for the same?

What is the Value of 24 lb. of double-refined Sugar, at 41, 175. per cwt.

What is the Value of 171b. of Malaga Raisins, at 31.

### 18. TARE and TRETT.

n this Rule there are fix Things to be observed, viz.

he Gross-wt. 2. Tare. 3. Trett. 4. Suttle. 5. Cloff. 6. Net Weight.

he Gross-Weight is, the whole Weight of the Goods, and that which they are packed up in.

2. Tare

2. Tare is an Allowance made to the Purchaser to Weight of the Box, Bag, Barrel, or whatever con the Goods bought, and is either

At so much in the whole Gross Weight.

At fo much per Box, Bag, &c. or

At fo much per Cent.

3. Trett is an Abatement of 4 lb. per 104 lb. and i twenty-fixth Part allowed for Waste, Dust, &c. by the Merchant to the Buyer.

4. Suttle is when the Tare is deducted from the Gross

on every Draught above 3 cwt. on some Sorts of 6 as Beaver, Galls, Madder, Argol, &c.

6. Net Weight is when all Allowance is deducted fro

Grofs.

The Court of Charles

2000

### The As at Note of C A S E I.

When the Tare is at so much in the Gross Weight to

### R U L E.

Subtract the Tare from the Gross, and the Remain the Net Weight.

## EXAMPLES.

cwt. 2 qrs. 16 lb. of Sugar; what is the Net West

Groß 194 2 16 Tare 12 3 15

What is the Net Weight of 24 Hogheads of Tole each weighing 6 c. 2 qrs. 17 lb. Gross. Tare is Whole 17 c. 3 qrs. 27 lb.

it is the Net Weight of 5 hhds. of Sugar, weighing as lows, viz.

into alt.	c.	grs.	16.	grs. 16.
No. 1,	4	2	14	Tare o 21
2,	3	0	17	0 18
3,	5	3	10	I day
4,	6	I	16	0 27
5,	3	2	18	0.19
Gross Tare				i o i i i i i i i i i i i i i i i i i i

Net

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## CASE II.

n Tare is at so much per Box, Bag, &c. to find the

# RULE TO LE

iply the Tare of each Box, Bag, &c. by the Number s, &c. the Product subtract from the Gross as before, Remainder will be the Net Weight.

### EXAMPLES.

Chests of Tea, each weighing 2 cwt. 1 qr. 17 lb.
os, Tare at 26 lb. per Chest: What is the Net Weight
the Whole?

Anf. Net 34 1 2 24: S. T. of this

5. What is the Net Weight of 8 Frails of Raifing weighing 2 cwt. 3 qrs. Gross, Tare at 22 lb. per

6. What is the Net Weight of 40 Bales of Silk, each ing 3 cwt. 27 lb. Gross, Tare at 18 lb. per Bales

# CASE III.

When Tare is at so much per cwt. to find the Net We

### RULE.

Divide the whole Gross, by the said Part or Parts the Tare is of a cwt. and the Quotient thence arisings the Tare, which subtracted from the Gross, as before give the Net Weight.

# EXAMPLES.

7. What is the Net Weight of 64 cwt. 3 qrs. 14 lb.
Tare at 16 lb. per cwt.

ceut. gr. lb. 16 lb.=\frac{1}{7})64 3 14 Gross. 9 1 2 Tare.

# Anf. 55 2 12 Net.

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8. What is the Net Weight of 22 Barrels of Figs each 1 qr. 17 lb. Gross, Tare at 14 lb. per swt.?

9. What is the Net Weight of 9 hhds. of Sugas

weighing 6 cwt. 2 qrs, 12 lb. Gross, Tare at 17 cwt.?

# CASE IV.

When Tret is allowed with the Tare, to find Weight.

## RULE.

Find the Tare as before, and subtract it from the the Remainder will be the Suttle, which divide

he Quotient will be the Tret, which subtract from the e, the Remainder will be the Net Weight?

## EXAMPLES.

f from 846 cwt. 1 qt. 7 lb. Gross Weight, Tare is to be subtracted after the Rate of 22 lb. per cwt. and from the Remainder Tret is to be allowed after the Rate of 4 lb. per 104 lb. what is the Net Weight.

16 lb.	1 7	cwt.	qr.	16. 7 G	roſs	
4 lb. 2 lb.	4412	120 30	3 0	17 25 12	4 10	
		166	0	26	14	Tare
	20	5)680		8 17	2 8	Suttle Tret
	An	r. 653	3	16	10	ne

hat is the Net Weight of 16 cwt. 3 qrs. Gross, Tare cwt. 1 qr. 12lb. and Tret 4 lb. per 104?
27 Bags of Cossee, each weighing Gross, 2 cwt. 3 qrs. 7 lb. Tare 13 lb. per 112 lb. and Trett 4 lb. per 04 lb. what is the Net Weight.

## CASE V.

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When Cloff is allowed, to find the Net Weight.

# RULE.

de the whole Gross, by 168, 2 lb. being 168th Part of or 336 lb. or you may divide the Number of c's by 3, brings them into 3 c's, then 2 lb. being allowed for 3 c. so as many 3 c's as it produces, so many 2 lb. it low, which divided by 56 (the double Pounds in a cwt.) otient will be the Hundreds, and the Remainder will

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be so many 2 lb's to which adding what may be allowed the odd c's. qrs. and lb. of the given Weight, will make whole Closs, which subtract from the Gross will be the Weight.

## EXAMPLES.

Gross, allowing for Closs 2 lb. for every 3 cwt.

enut. qrs. lb.
168)5647 3 13 Grofs.
33 2 13 Cloff.

Anf. 5614 1 0 Net.

Or thus 3)5647(1

56) 1882 (33 cwts. 2 qrs. Cloffs as before.

34

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14)34(2 qrs.

The Allow- 6=12lb. }+13lb.

14. What's the Net Weight of 14 Barrels of Spices, wi ing all together 42 cwt. 3 qrs. Gross, allowing for 2 lb. per 3 cwt.

### CASE VI.

When Tare, Tret, and Cloff, be allowed with any Q tity (Gross) to find the Net Weight.

## RULE.

For the Tare and Tret, proceed as in Case 4, and the mainder, which was called the Net there will be the shere, which to find the Cloff of, proceed as in the last contract the same of the contract the same of the contract the

### EXAMPLES.

15. What is the net Weight of 15 cwt. 3 qrs. 20 Groff

lowing for Tare 7 lb. per cwt. Tret 4 lb. per 104 lb. and Cloff 2 lb. for 3 cwt.

cwt. qr. lb. oz.

14 lb. 
$$\frac{1}{8}$$
 15 3 20 0

7  $\frac{1}{2}$  1 3 27 8

0 3 27 12 Tare

4  $\frac{1}{26}$  14 3 20 4 Suttle
0 2 84 4 Tret

168)14 1 12 0 Suttle
0 0 9 9 Cloff

Anf. 14 1 2 10 Net

What's the Net Weight of 4 hhds. of Sugar, weighing as follows, viz.

```
c. lb. qrs.

1 4 2 17
2 5 3 14
   Tare 8 lb. per cwt. Tret 4 lb. per
3 3 2 26
4 6 2 12
   Tare 8 lb. per cwt. Tret 4 lb. per
```

# QUESTIONS for EXERCISE.

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Groß

The Net Proceeds of a Hoghead of Barbadoes Sugar, were 41. 141. 6d. the Custom and Fees 21. 81. 6d. Freight 221. 8d. Factorage 41.9d. The Gross Weight was 9 cwt. 3 qrs. 10lb. Tare 1lb. in 10: Pray then how was the Sugar rated in the Bill of Parcels? have imported 80 Jars of Lucca Oil, each containing the folid Inches: What came the Freight to at 41. 6d. per cwt. Tare 1lb. in 10, counting 7½ lb. of Oil to the Wine Gallon of 231 Cubic Inches?

# 19. SIMPLE INTEREST

Is that which arises only from the Principal, and Profit allowed by the Borrower to the Lender; for the lor Forbearance of any Sum of Money, for some determ Space of Time, and at any Rate (per Cent. per Ana agreed upon; which according to Law must not exceed for the Use or Interest of 100%. Principal, called Cent. so Months called Annum.

The Amount is the Principal and Interest added

ther.

Note, The Rules for Simple Interest serve also for culating Factorage, Brokerage, Insurance, Purchash Stocks, or any Thing else, that is rated at so much Cent.

### CASE I.

To find the Interest of any Sum of Money, for any N ber of Years.

### RULE.

Multiply the Principal by the Rate per Cent. that Principal divided by 100, will give the Interest for a Year, multiplied by the Number of Years given, and the Principal be the Answer.

# EXAMPLES.

1. What is the Interest of 370l. for a Year, at 5l. per per Annum.

370 Principal
6 Rate per Cent.

£. 18|50

. to oo

Anf. 18% 100.

What is the Interest of 8241. 18s. 2d. for a Year, at 4 per

Cent. per Annum?

What is the Interest of 5001. for 4 Years, at 5 per Cent. per Annum ?

What is the Amount of 5261. 18s. 8d. for 9 Years, at 4

per Cent: per Annum?

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er

What is the Amount of 2641. 4d. for 12 Years, at 5 per Cent. per Annum ?

### CASE

Then the Rate per Cent. is 1, 1, or 1, more than the nds given in the faid Rate.

### RULE.

fultiply the Principal by the Pounds in the Rate per t. as in the last ( afe, then take Parts for I, I, or I, from Principal, which add to the Product, and the Sum diby 100, as before.

## EXAMPLES.

What is the Interest of 2461. 181. for a Year, at 41 per Cent, per Annum ?

> 1 1 246 18 Principal' 987 12 =47 41 Rate per Cent. 61 14 6= Anto 49 6 6 20

s. 9 86 12 Ahfw. 10l. 91. 104d. 33 d. 10 38

gr. 1152

# 19. SIMPLE INTEREST

Is that which arises only from the Principal, and is Profit allowed by the Borrower to the Lender; for the Loa or Forbearance of any Sum of Money, for some determined Space of Time, and at any Rate (per Cent. per Annum agreed upon; which according to Law must not exceed so for the Use or Interest of 1001. Principal, called Cent. for 1 Months called Annum.

The Amount is the Principal and Interest added togs

ther.

Note, The Rules for Simple Interest serve also for calculating Factorage, Brokerage, Insurance, Purchasings Stocks, or any Thing else, that is rated at so much process.

### CASEL

To find the Interest of any Sum of Money, for any Nuber of Years.

### RULE.

Multiply the Principal by the Rate per Cent. that Productivided by 100, will give the Interest for a Year, whi multiplied by the Number of Years given, and the Productivity of the Answer.

## EXAMPLES.

1. What is the Interest of 370l. for a Year, at 5l. per caper Annum.

370 Principal
6 Rate per Cent.

£. 18|50

. 1000

Anf. 18% 100.

en

ide

What is the Interest of 8241. 18s. 2d. for a Year, at 4 per Cent. per Annum?

What is the Interest of 5001. for 4 Years, at 5 per Cent.

What is the Amount of 5261. 18s. 8d. for 9 Years, at 4

What is the Amount of 2641. 4d. for 12 Years, at 5 per Cent. per Annum?

### CASE II.

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CEL

When the Rate per Cent. is 4, 2, or 2, more than the bunds given in the faid Rate.

### RULE.

Multiply the Principal by the Pounds in the Rate per lent as in the last ( ase, then take Parts for 1, 1, or 1, from he Principal, which add to the Product, and the Sum dide by 100, as before.

# EXAMPLES.

What is the Interest of 2461. 183. for a Year, at 41 per Cent. per Annum?

£ 1. 246 18 Principal

Antol49 6 6

1. 9|86 12 Answ. 101. 91. 104d. 23 2. 10|38

4

gr. 1152

7. What is the Amount of 3201. 10s. 10d. for 3 Years, a 3½ per Cent. per Annum?

8. What is the Interest of 140%. 10s. for 7 Years, at 4 pe

Cent. per Annum?

9. What is the Amount of 470% for 5 Years, at 31 per Cent per Annum?

# COMMISSION

Is an Allowance from a Merchant to his Factor, or Correspondent abroad, in buying and selling of Goods, and at a certain Rate per Cent. according to the Custom of the Country, where the Factor resides.

This, as well as Brokerage and Insurance, is computed in the same Manner, as in Case I, for even Pounds, and

for 1, 1, or 2, as in the last Case.

## EXAMPLES.

upon my Account, to the Value of 4741. 141. 6d. demand to know what his Commission comes to, at per Cent.?

2. 6|85 Anf. 151. 81. 634. 38

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1. Suppose I allow my Correspondent 2½ per Cent. for his Commission; what is his Demand, on the Disbursement of 7421. 125. 6d.

2. What must I allow my Factor, for the Disbursing on my

Account, 3741. 195.103d. at 2 per Cent ?

# BROKKRAGE

Is an Allowance or Fee paid unto a Person called a Broer, for assisting others in buying or disposing of their Goods, ad in the City of London they are not to ast without a cence from the Lord-Mayor.

### CASE III.

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To find the Brokage for any Sum, at any Rate under 12.

### RULE.

Divide the given Sum by 100, and it will give the Intel at 11. per Cent. which Interest you must take Parts om, with the Rate per Cent. and add them together, the m will be the Brokage required?

# EXAMPLES.

. What is the Brokage of 4201. 12s. 6d. at 6s. 4d. per Cent?

Suppose I employ a Broker, who sells Goods for me, to the Value of 1000l. what may he demand for Brokerage, it being at 4. 6d. per Cent?

15. Suppose

Amount of 5401. 101. what comes the Brokage to, a 131. 10d. per Cent?

16. What is the Brokage of 24741. 15s. at 19s. 92d. 1

Cent.

## INSURANCE

Is a Contract or Agreement, whereby one or more lessons, called Insurers, &c. oblige themselves to answer to the Loss or Damage of Ships, Houses, Goods, &c. b Storms, Fires, &c. in Consideration of a Premium, paid the Proprietors of the Thing injured.

To find the Insurance of any Sum, at any Rate under

proceed as in the last Case, if above, as in Case 1.

## EXAMPLES.

17. Suppose I insure for 1460/. at 21. 6d. per Cent. per h

14|60 | | 14 12 0 | ...
20
Anf. 1 16 6

r8. What is the Insurance of 2460l. at 101. 15. per Cen

which I made an Insurance at 671. per Cent. what do it come to?

20. What is the Infurance of an East-India Ship and Car

valued at 74061. 175. 6d. at 154 per Cent?

# PURCHASING of STOCKS

Stocks are the public Funds of the Nation, the Shar of which being transferable from one Person to anoth occasions that extensive Business called Stock-Jobbing.

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# RULE.

Multiply the Sum to be purchased, by the Excess of the ate per Cent. above 100, the Product divide by 100, as fore, and the Quotient added to the given Sum, wilk we the required Purchase.

If under Par, i. e. if under 100 per Cent. proceed as in ase II.

# · E X A M P L E S.

What is the Purchase of 400%. South Sea Stock, at 120%, 51. per Cent.

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£. 81 00

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. What is the Purchase of 460l. Bank Stock, at 873 per Cent?

What is the Purchase of 2470l. 17s. 10d. Bank Annuities, at 1032 per Cent?

What is the Purchase of 876l. India Stock, at 114 per Cent?

## CASE III.

When the Interest is for \$, \$, or \$ of a Year, or any Numer of Years besides.

### RULE.

Find the Interest for the Years, as in Case 1, then for 1, or 3, take Parts from the Interest of 1 Year, i. e. for take one fourth Part of the said Interest, for 1, take one sign and for 1, take the Parts compounded of 1, that is half for 1, then half of that half for 1, which added to sinterest for Years (if any) the Sum will be the Interest quired.

EXAMPLES.

# EXAMPLES.

25. What is the Interest of 427 l. 10s. for four Menths, at per Cent. per Annum?

26. What is the Interest of 246 l. 12 s. 6 d. for one Years 1, at 5 per Cent. per Annum?

27. Lent 298 1. 18 s. upon a Mortgage, to receive Interfor the same, at 4½ per Cent. per Annum, till it we paid off, which was not till the End of 4½ Years after now I should be glad to know what's due to me?

for her Fortune, to be paid her, when at Age, with terest, a 5 ½ per Cent. per Annum. Now she came Age in 3 Years, 9 Months, after her Father's Dead What is the Amount of her Fortune, that is, what is to receive in all, Principal and Interest?

# CASE IV.

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ods.

When the Interest required is for any Number of Week

## RULE.

3. Find the Interest of the given Sum for a Year, as Case I.

Sum: : fo are the Weeks given: to the Interest quired.

### EXAMPLES.

29. What is the Interest of 400 l. 15s. for 4 Weeks at 4

	. 이 교육이 하다면서 이번 경에 가르게 되어 만든 것이 아니라 하는 것 같아요. 이 모든 하나 있다면서
1. s. 400 15	wks. l. s. d. wks.  If 52: 16 0 7:: 4
4 per Cent.	
16103 0	320
20	12
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. 0 60	3847
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d. 7 20	52)15388(295 d.
	498 20)2,4 7
	308 l. 1 4 73 Anf.
	Rem. 48 Pence
	Acm. 40 I chec
	52)192(3 qrs.
	Rem. 36 qrs.

What is the Amount of 600 l. for 26 Weeks, at 3 \(\frac{3}{4}\) per Cent. per Annum?
What is the Interest of 740 l. for 4 Years and 42 Weeks, at 5 per Cent. per Annum?
What is the Amount of 200 l. for 5 Years and 50 Weeks, at 4\(\frac{1}{2}\) per Cent. per Annum?

## CASE V.

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find the Interest of any Sum, for any Number of Days.

# RULE.

ay as 365 Days: are to the Interest of the given Sum for are: so are the Days given: to the Interest required: us, Reduce the Principal into Pence, which multiply by Number of Days, and that Product by the Rate per Cent. Dividend, then multiply 365 (the Days in a Year) by for a Divisor, by which divide the Dividend, and the tient will be the Answer in Pence, which bring to ads.

# A TABLE of Days for any given Time less than a Ye

1 1 32 60 91 121 152 182 213 244 274 305 2 2 3 5 61 92 122 153 183 214 245 275 306 3 3 3 4 62 93 123 154 184 215 246 276 307 4 4 35 63 94 124 155 185 216 247 277 308 5 5 36 64 95 125 156 186 217 248 278 300 6 6 37 65 96 126 157 187 218 249 279 310 7 7 38 66 97 127 158 188 219 250 280 311 8 8 39 67 98 128 159 189 220 251 281 312 9 940 68 99 129 160 190 221 252 282 313 10 10 41 69 100 130 161 191 222 253 283 314 11 11 42 70 101 131 162 192 223 254 284 315 3 12 12 12 43 71 102 132 163 193 224 255 285 3163 13 13 44 72 103 133 164 194 225 256 286 317 3 14 14 45 73 104 134 165 195 226 257 287 318 3 15 15 15 40 74 105 135 166 196 227 258 288 319 3 15 15 15 40 74 105 135 166 196 227 258 288 319 3 15 15 15 40 74 105 135 166 196 227 258 288 319 3 15 15 15 40 74 105 135 166 196 227 258 289 320 3 17 17 17 48 76 107 137 168 198 229 260 290 321 3 15 15 15 40 74 105 135 166 196 227 258 289 320 3 17 17 17 48 76 107 137 168 198 229 260 290 321 3 19 19 50 78 109 139 170 200 231 262 292 323 32 20 20 51 79 110 140 171 201 232 263 293 324 35 20 20 51 79 110 140 171 201 232 263 293 324 35 22 22 53 81 112 142 173 203 234 265 295 326 35 22 22 55 684 115 145 175 205 236 267 297 328 35 25 25 56 84 115 145 177 207 238 269 299 330 36 27 27 58 86 117 147 178 208 239 270 300 331 36 28 28 59 87 118 148 179 209 240 271 301 332 362 28 28 59 87 118 148 179 209 240 271 301 332 362 29 29 60 88 119 149 180 210 241 272 202 232 232 232 232 232 24 25 25 25 60 88 119 149 180 210 241 272 202 232 232 232 232 232 24 25 25 25 60 88 119 149 180 210 241 272 202 233 233 234 265 299 330 360 27 27 58 86 117 147 178 208 239 270 300 331 36 28 28 59 87 118 148 179 209 240 271 301 332 362 28 28 59 87 118 148 179 209 240 271 301 332 362 29 29 60 88 119 149 180 210 241 272 202 232 232 232 232 232 232 232 232 23	Days	January	February	March	April	May	June	July	August	September	October	Nove	
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### The USE of the TABLE.

the Year to any given Day of any Month.

the 1st, to August the 8th, is 220 Days; to November the 24th is 328 Days, &c.

given Day of any Month, to the End of the Year.
Suppose August 8th, then from 365 Days.

ubtract the Number answering to August 8, 220

There remains the Number of Days, viz. 145

rdly, To find the Number of Days between the given Day of any Month, and any given Day of any other Month, in the same Year.

Instance, To know how many Days there are between May the 9th, and November the 5th.

ract that answering to May 9.

Remainder is the Number of Days sought, 129

thly, To find the Number of Days from any given Day of any Month in one Year, to any given Day of any Month in the next Year.

many Days is it from October the 12th in one Year, to June the 10th in the next.

s, From the Days of a whole Year,

act the Number answering to Oct. 12, viz. 285

ains the Number to the End of the Year, So hich add the Number to June 10 - 161

Sum is the Number of Days required, viz. 241

d thus is the Number of Days readily found for any al of Time given, in the same Year completely; or is Part of one, or Part of another Year.

# EXAMPLES.

33. What is the Interest of 2001. for 120 Days, at 51 Cent. per Annum?

L.	Days. L. Days.	or otherwise thus;
5	If 365—10—120 120	240 Pence in a f.
1. 10 00	365)1200(3/.	48000
	Rem. 105%.	120 Days
	365)2100(51.	57600100 365 5 Rate
	Rem. 275s.	100—(12
	365)3300(9d.	3250 20 6 5 9
	Rem. 15d.	3300 £. 3 5 93 5
		15

Annsw. 31. 5s. 9d 355

34. What is the Amount of 340l. 10s. from January 1771, to July 18 following, at 5 per Cent. per Am 35. What is the Interest of 500l. from December 4, 17 to March 10, 1774, at 4 per Cent. per Annum?

### CASE VI.

When the Amount, Time, and Rate per Cent. are gitto find the Principal.

### RULES.

1. Say, as the Amount of 100l. at the Rate and I given: is to 100l.: fo is the Amount given to the cipal required: Or,
2. The Example in this and the two following Cafe

be folved by the Rule in Sect. 15.

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### EXAMPLES.

What Principal, being put to Interest for 6 Years, at 5, per Cent. per Annum, will amount to 343 l. 452

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5 Rate per Cent. If 130: 100:: 343 4
6 Time 20 20
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26,00)686400(264 /. Anf.

What Principal, being put to Interest for  $9\frac{1}{2}$  Years, at  $4\frac{1}{2}$  per Cent. per Annum, will amount to 856 l. 10s. What Principal, being put out to Interest for  $7\frac{1}{4}$  Years, will amount to 614 l. 3s. 11 d. at 3 per Cent. per Ann.?

### CASE VII.

When the Principal, Rate per Cent, and the Amount are en, to find the Time.

### R.U.L.E.

, as the Interest of the Principal for a Year: is to 1 Yea

# EXAMPLES.

In what Time will 264 1. amount to 343 1. 4 3. at 5 per Cent. per Annum?

30 79 4 Int. 264 264) 1584(6 Years the And

lowhat Time wi

In what Time will 600 h amount to 856 h. 10 s. at 4 per Cent. per Annum?

L 2

41. In what Time will 498 l. 6 s. 8 d. amount to 614 l. 34
11 d. at 3 per Cent. per Annum?

### CASE VIII.

When the Principal, Amount, and Time are given, and the Rate per Cent.

#### RULE.

1. Say, as the Principal: is to the Interest, for the whole Time: fo is 100 %, to the Interest for the same Time

2. Divide that Interest by the given Time, and the Quotien will be the Rate per Cent. required.

### EXAMPLES.

42. At what Rate per Cent. per Annum, will 2641. amou to 3431. 41. in 6 Years?

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343 4 Am. If 264: 79 4:: 100

264 o Prin. 20

79 4 Int.

1584

# 264) 158400(20)60,0 Shillings

# Time 6)30%

Anf. L. 5 Rate per Cent.

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43. At what Rate per Cent. per Annum, will 600 l. amou

44. At what Rate per Cent. per Annum, will 4981.65. amount to 6141. 3 s. 11 d. in 7 3 Years?

QUESTIONS for Exercise in the Eight last Cases, at lei Hours.

45. Lent at Christmas 1771, the Sum of 5000 l. at 41 Cent. after which Time I lent several Sums at the Rate, and drew upon the Borrower, as Business requivize on Lady-day 1772, I drew for 185 Guineas Midsummer day following, I lent 500 Moidores;

drew for 700 l. and on Michaelmas-day, in the same Year, I lent 569 1. 175. : I demand what Cash the Borrower owed me at that Time?

On the first of May 1771, I lent Ralph Newlands per Bill at one Day's Date, 500 l. which I received back in the following partial Payments; viz. On the 13th of May, 50 1. on the 4th of June 56 1. on the 14th of July 44 1. on the 23d ditto co.l. on the 18th of August 87 1. on the 30th ditto 13% on the 21st of September 30%. on the 18th of October 30 % on the 29th ditto 40 % on the 11th of November 50 %, and on the 28th of December 50 !. Now I demand to know what Interest is due

at oper Cent. per Annum?

Lent to John Jameson, per Bill, dated 18th of Jan. 1771, payable one Day after Date, 878 1. 19 s. to d. which I received back in the following partial Payments; viz. on the 27th of February 57 l. 15 s. 7 d. on the 18th of March, 37 1. 14 s. on the 29th of April 34 1. 11 s. on the 12th of May 1361. 15 s. 7 d. on the 19th of June 671. 13s. 4 d. on the 15th of July 15 Guineas and 6 d. on the 25th ditto 1111. 111. 11 d. on the 3d of October 781. 7s. 4d. on the 19th of November 100 l. on the 23d ditto, 100 l. and on the 30th of December received the Ballance of the Principal: How much Interest ought I to claim at 5 per Cent.

Lent 109 Guineas at 4 per Cent. by the 18th of August 1769, was raised by the Interest to so many Moidores; abating Half a Crown, pray on what Day did the Bond

bear Date.

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frool in 12 Years be allowed to gain 391. 191. 8 d. in what Time will any other Sum double itself at the same

Rate of Interest?

A Bond was made on the 7th of August 1766, at 6 per Cent. per Annum, for 1114 1. 10s. on the 11th of May 1771, 1401. was paid off, and a fresh Bond entered into or the Remainder, at 5 1 per Cent. per Annum, at the Time the Interest for this last was 21 1. 16s. 8 d. there was paid off 87 1. 11 s. 9 d. The old Bond being then taken up, a new one was given for the Residue, which king paid off September 11, 1777, the Bond-Owner tok no more than 1409 l. 16 s. 8 d. in full Payment: at hat Rate did he take Interest per Cent. per Annum, on the last Renewal of the Bond?

L 3

a little Respite, to admit a sober industrious young Fellow in the Business; and to encourage him offers, that if his Circumstances will allow him to advance 100 lines Pay shall be 40 l. a Year; If he shall be able to put 200 l. into the Stock he shall have 55 l. a Year, and if 300 l. he shall receive 70 l. annually: In this Proposal, what was allowed for his Attendance simply? and what Rate per Cent. was allowed for his Money?

nuities, at 1113 per Cent. viz. The Day before the closing the Books, the Brokerage whereof is always 25.6-d. per Cent. on the Capital, whether you buy of fell: The Midsummer Dividend 2 per Cent. becamed and payable on the 10th of August following; by which Time the Rebellion growing considerable in the North the said Annuities were down at 92½ per Cent. In the general Alarm, sold 400 l. Capital at that Price; but continued the Remainder, till a second, third, south and fifth Dividend, as before, came due; and on open ing the Books on the 10th of August 1747, sold out a 102 3 per Cent. Now reckoning I might have made per Cent. of my Money, had I kept it out of the Stocks how stood this Article in point of Profit and Los?

### 20. COMPOUND INTEREST

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Is that which arises both from Principal and its Interput together, as the Interest becomes due, but not paid; same Interest is allowed upon that Interest unpaid, as we upon the Principal, so it becomes Part of the Principal; a for which Reason it is called Interest upon Interest, or compound Interest.

It is not lawful to let out Money at Compound Interest yet in Purchasing of Annuities or Pensions and Leases Reversion, it is usual to allow Compound Interest to the state of the for his Ready Money, and therefore makes it necess

that it should be understood.

But as it may (as well as other Cases of Interest) be more conveniently performed by Decimals, so shall only here at the Rule, and two or three Examples.

### RULE.

Find the first Year's Interest as in Case I. add that Interest to the Principal, which Sum will become the second Year's Principal, and so on for any Number of Years. Subtract the given Principal from the last Amount, and the Remainder will be the Interest required.

### EXAMPLES.

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What is the Compound Interest of 600 l. forborn 3 Years at 5 per Cent. per Annum?

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		31 10	
. 30loo	630=20	Y. Pr.	
	5	661 10=3d Y. Pr.	
661 10 0		5	
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694 II 6 Am.	1. 1000	20	Property of
600 o o Prin.		<del></del>	
·		1.150	B. A.
6.94 11 6 Com	p. Interest	12	
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What is the Amount of 150 L for 5 Years at 4 per Cent.
per Annum, Compound Interest?

d. 6 00

What is the Compound Interest of 440 l. 16 s for 4 Years, 7 Months, and 15 Days, at 5 per Cent. per Annum?

te, When the Interest is required for Months and Days besides Years, you must find the Interest for one Year more than the Number of Years given, and from that Year's Interest, take Parts from, for the Months and Days, which add to the last Year's Interest, and the Sum will be the Interest required.

# 21. REBATE, or DISCOUNT,

the abating of so much on a Dobt, to be paid before it mes due, which Payment, (Rebate being deducted) if put

put out to Interest for the same Time and Rate per Cent. per Annum, would be equal to the Sum first due.

### RULE.

1. Find the Interest of 100 l. for the Time given, and Rate

per Cent. which Interest add to 100%.

2. As that Sum: is to the Interest of the 100% or to 100: fo is Debt or Sum proposed: to the Rebate or present Worth required. Or, subtract the Rebate from the given Sum, and the Remainder will be the present Worth, or Money to be paid down.

### EXAMPLES.

1. What is the Rebate of 420 l. for 7 Months, 6 Days, at per Cent. per Annum?

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1 6	1 5	2	per Cent	103	1260	(12 4	d. $7\frac{3}{4}\frac{71}{163}$	Rebat	e
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		-						- 1.	s. d.
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	]	00	o Int. o Prin.				Rébate	12	47
			<u> </u>						
	1	03	0				P. Wort	h 407	15 4

2. What is the present Worth of 100 l. for 12 Months, at of per Cent.?

3. What is the Rebate and present Worth of 6001. 103. 64 payable in 10 Months, at 4 per Cent. per Annum?

4. What is the Discount of 890 1. 16 s. being due July 27
1770, this being December 12, 1769, at 5 per Cent. pe
Annum?

Months, that is, Half at 4 Months, and the other Hal at 8 Months: What must be discounted for the present Payment of the Whole, Discount being at 5 per Cent per Annum?

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Suppose I have a Legacy of 550% left me, on the 21st of May, 1769, but not to be paid till Christmas-Day following; what is the present Worth, Discount allowed,

at 5 per Cent. per Annum?

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What is the present Worth of 32201. payable as follows, 100/. at 3 Months, 60%. at 5 Months, and the Remainder at 9 Months; Discount at 6 per Cent. per Annum?

Sold Goods to the Value of 400l. to be paid, at three Months, as follows, viz. first 1, second 1, and the rest the third Payment, what is the Discount, and present Worth of the Whole, at 41 per Cent. per Annum?

What ready Money will discharge a Debt of 3601. due at two 5 Months, that is, 1 at 5 Months, and the rest

at 10; Difcount at 3 per Cent. per Annum?

What Difference is there between the Interest of gool. at per Cent. per Annum, for 12 Years, and the Difcount of the same Sum, at the same Rate, and for the fame Time?

What ready Money will discharge a Debt of 133771. 135. 4d. due two Years, three Quarters, 25 Days hence, Discount, at 43 per Cent per Annum?

# 22. EQUATION of PAYMENTS

Is when several Debts are payable at different Times, but mutually agreed between Debtor and Creditor, that all ble several Sums be paid at once, and at such a Time as, t neither Party may be wronged thereby, this is called lating the Time of Payment. The common Rule is as lows.

### RULE.

Multiply the Sum of each particular Payment by its Time, n add these Products together, and divide the Sum by the ole Debt, the Quotient (by this Rule) is the equated me for the Payment of the Whole.

### EXAMPLES.

Aowes B 1001, which by Agreement was to be paid-as follows, viz. 501. at two Months, and 501. at fix Months; but they afterwards agree, that the Whole thould:

should be paid at once; required the equated Times

£. Mo. 50×2=100 50×6=300

1,00)4100

Answ. 4 Months.

2. B owes C 6001. whereof 2001 is to be paid at 3 Months, 1501. at four Months, and the rest at fix Months; but they afterwards agreed the Whole should be paid a once, required the Time?

3. A bought of B a Quantity of Goods, which came to 4601. to be paid in the following Manner, viz. 2001 at 7 Months, and the rest at 5 Months, but afterward they agree to make one Payment of the Whole; Ide

mand the equated Time?

4. Cowes D a certain Sum, which is to be discharged the following Manner, viz. 1/2 at 3 Months, 1/3 in Months, and 1/6 at 9 Months, but they afterwards ago to have but one Payment of the Whole: the equals Time is required?

5. A Debt is to be discharged thus, viz. 1 present, 1 at Months, 1 at 5 Months, and the rest at 6 Months, wh

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is the equated Time for the Whole?

6. E is indebted to F 2401. which by Agreement is to paid at 5 Months hence; but E is willing to pay his 401. down, provided he will give him a longer Time for the Payment of the Remainder, which is agree on; the Time of Payment is required?

# 23. SINGLE FELLOWSHI

OR,

# FELLOWSHIP WITHOUT TIME,

Is when two or more Persons join their Stocks, and The together: To determine each Person's particular Share

e Gain or Loss, in Proportion to his Principal paid into e Stock, observe the following

### RULE.

As the Sum of the feveral Stocks: to the Gain or Loss, so is each Person's Share in the Stock: to his Share of e Gain or Loss.

### PROOF.

Add all the Shares together, and that Sum (if right) will equal to the whole Gain or Loss.

### EXAMPLES.

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Two Merchants, A and B, join in Partnership; A lays in Sol. B Sol. and they gain 281. what is each Man's Share of the said Gain?

A's Stock, 80 If 140: 28:: 80: 16 A's
B's 60 If 140: 28:: 60: 12 B's

A's Gain, 16

Sum 140 B's 12

Proof, 28 £.

Three Persons, C, D, and E, trade together, and make a joint Stock of 8241. and in three Years Time they gained as much, and 701. over; C's Stock was 3201. D's 3401. I demand E's Stock, and what each Person gained by trading?

Suppose four Merchants, A, B, C, and D, join their Stocks and Trade together, of which A put in  $\frac{1}{2}$ , B  $\frac{1}{3}$ , C  $\frac{1}{4}$ , and D  $\frac{1}{5}$ , but, at the Expiration of 12 Months, they had the Misfortune to lose 1201. what must each

Person suffer of the said Loss?

Three Merchants, D, E, and F, in Partnership together, and with one common Stock of 400l. they gained as follows, viz. D 30l. E 48l. and F 42l. what was each Man's Stock?

Suppose the Money and Effects of a Bankrupt, amounted to 24201. 17s. 6d. and he is indebted as follows, viz.

to A. 1000l. to B 640l. to C 900l. and to D 842l. is how must his Effects be divided amongst them, that is what must each have?

# QUESTIONS for Exercise at Leisure Hours.

6. A Father, ignorant in Numbers, ordered 5001. to a divided amongst his five Sons, thus, give A, says he 1/3, B 1/4, C 1/5, D 1/6, and E 1/7: part this equitably them, according to the Father's Intention?

7. Three Persons purchase together a West-India Sloot towards which A advanced \(\frac{3}{8}\), B \(\frac{1}{7}\), and C \(\frac{140}{140}\) how much paid A and B, and what Part of the Vess

had C?

8. A and B clear by an Adventure at Sea 50 Guineas, with which they agree to buy a Horse and Chaise; where they were to have the Use, in Proportion to the Sur adventured, which was found to be A 10; to B; they cleared 45 per Cent. what Money then did extend abroad?

9. A and B join their Stocks, and vest them in Brandie A's Stock was 191. 195. 8d. more than that of B; no by selling out their Commodity at 555. per Anchor, cleared 741. 115. and B just 50 Guineas. The Quanti of Brandy dealt for is required, and the Gain upon the

Anchor?

venture was 35s. more than B's, whose Share of the Profit is but 8s. 6d. what are the Particulars of the

Stock?

which A contributed 210%. B 312% they cleared 140 whereof 37% 105. belongs of Right to C. That Pe fon's Stock, and the several Gains of the other two a required?

Trade 1541. by Agreement A was to have 8 per Car because he spent Time in Execution of the Project, a B was to have only 5. The Question is, what was

lotted A for his Trouble?

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A, B, and C, are three Horses belonging to different Men, and are employed as a Team to draw a Load of Wheat from Hertford for 30s. A and B are deemed to do  $\frac{2}{7}$  of the Work, A and C  $\frac{3}{8}$ , and B and C  $\frac{3}{18}$  of it; they are to be paid proportionally, and do you know

how to divide it as it should be?

Bought 100 Quarters of Malt, Meal, and Oatmeal, together, for 1421. For every 5 Bushels of Malt, I had 3 of Meal, for every 8 of Meal, I had 7 of Oatmeal; pray what did these cost me severally a Bushel, the Malt being half as dear again as the Meal, and the Meal being double the Price of the Oatmeal?

In raising a Joint Stock of 4001. A advanced 4, B 12 of 3, C 1 more; the Difference between A's Adventure and B's, and D the rest of the Money; what

did every one subscribe?

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ect, a was A Father devised 34 of his Estate to one of his Sons, and 34 of the Residue to another, and the Surplus to his Relict, for her Life; the Children's Legacies were found to be 2571. 3s. 4d. different; pray what Money did he leave the Widow the Use of?

# DOUBLE FELLOWSHIP,

# FELLOWSHIP WITH TIME,

when each Person's Stock continues unequal Time in ppany, so that a Consideration must be made of the e as well as of the Stock.

## RULE.

ultiply each Person's Stock by the Time it has contiin Trade, and proceed with the Products, as with the cular Stocks in Single Fellowship.

PROOF.

# PROOF.

As in Single Fellowship.

### EXAMPLES.

i. Three Merchants, A, B, and C, enter into Partnership, thus; A puts into the Stock 2401. for 4 Months, 8 1201. for 6 Months, and C 2001. for 8 Months; with this Joint Stock they traffic and gain 2601. it is required to find each Person's Share of the Gain, proportionable to his Stock and Time of employing it?

240 and multiplied by \{ \frac{4}{6} \} Months \{ \frac{960 = A's}{720 = B's} \} Stock and Time,

Sum 3280

1. 1. 1. 1. 1. 1. 3. d. Ref.

If 3280: 260:: 1600 A's Gain, 76 1  $11\frac{1}{4}$ ?

1600 B's 57 1  $5\frac{1}{2}$ 1. 3. d. Ref.

1600 B's 57 1  $5\frac{1}{2}$ 1. 3. d. Ref.

1600 B's 57 1  $5\frac{1}{2}$ 126 16 7

126 16 7

127 Proof, 260 0 0

2. A Ship's Company take a Prize, Value 4000/. which to agree to divide amongst them, according to their and Time they have been on board; now the Officers and Midship-Men have been on board 4 Months, the Sailors 3; the Officers have 50s. a Month, Midship Men 40s. and the Sailors 28s: moreover, the are 4 Officers, 8 Midship-Men, and 120 Sailors; I mand to know what each Person's Share is of the Prize?

(

3. A, B. and C, rent a Piece of Land, for which they pay 401. per Annum; A puts in 60 Oxen for 4 Months, B 40 Oxen for 5 Months, and C 30 Oxen for the Remainder of the Year, what must each Person pay of the said Rent?

Three Merchants, A, B, and C, in Partnership together for a Year, put into one common Stock as follows, viz. A puts in 4001. and at 6 Months End withdraws 2001. B puts in 361. and at 7 Months End 1001. more, but at the End of 9 Months he takes out 1201. C puts in 1901. and at 8 Months End 1101. but at the End of 10 Months he takes out 1001. they gain 4601. what is each Man's Share?

# QUESTIONS for Exercise at Leisure Hours.

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5. A and B in Partnership equally divide the Gain; A's Money, which was 841. 125. 6d. lay for 19 Months, and B's for no more than 7; the Adventure of the latter is sought?

Months received 25 Guineas, and C, for lying out of his Contributions 5 Months, had a Title to 321. The Total of their Adventures multiplied into their respective Times, was 6401. What then were the Particulars?

A clears 131. in 6 Months, B 181. in 5 Months, and C 231. in 9 Months, with a Stock of 721. 105. what then did the general Stock amount to?

X, Y, and Z, in Company, make one common Stock of 4262l. X's Money was in 4 Months, Y's 6 Months, and Z's 9 Months, they gained 420l. which was to be divided in the following Manner, viz. ½ of X's Gain to be equal to ½ of Y's, and ¼ of Y's Gain to be equal ¼ of Z's. Quere, what each Person gained and put in?

A, B, and C, in Company; A put in his Share of the Stock for 5 Months, and laid Claim to  $\frac{1}{5}$  of the Profits, B put in his for 8 Months, C advanced 400l. for 7 Months, and required on the Balance  $\frac{2}{3}$  of the Gain; the Stock of the other two Adventurers is fought.

on the 10th took him a Journey into the West, and returned on the 10th of June following; B on the 2d of August took him into Scotland, and stayed till Now, 13, and this concluded his service for this Year. From Jan. 17th following, A used him ten Days, and in a Weeks after his Return, employed him till April 30th, B then rode him from May-day to Midsummer, A had him from the 14th of July to 14 Days after St. James' Tide; B, on Sept. 30th, took him into Norfolk, and came back Oct. 19th; he then was sold for 71. 101. and they would have the Money parted equitably between them, viz. in Proportion to the Use each made of the Steed?

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# 25. BARTER

Is the changing of one Commodity for another, and is forms us how to Proportion the Value of any Goods, so the neither Party may sustain Loss. And if the Commodition exchanged are not of equal Value, the Defect is supplied with Money.

# RULE.

given, then find what Quantity of the other, at a given Rate, you can have for the aforesaid Value, white Quantity will be the Answer.

but in Barterage advances it to something more, is
As the ready Money Price of the one: is to its Barte
ing Price: so is the Ready Money Price of the oth
to its Bartering Price; then the Quantity of the late
Commodity may be found either from the ready Mone
or Bartering Price.

### EXAMPLES.

Barter for 4 cwt. of Tea, at 12s. per Pound?

h has no broad Clothe, at 1th 100, a thirty tange required rai taking Wool, at a. c. two then, If 30: 1:: 5376 wer gay for the Cloth, and which of the Don't 448 lb. at 12s. per lb. 310)537/6(179 22123 Rem. 6 5376s. the Value of the Tea 30)6712(22

Answ. 179 cwt. 22 lb. 12

2 of To Rem. 12

How many Yards of Cloth, at 18, per Yard, must I give for 45 Yards of Shalloon, at 16d. per Yard?

A and B Barter, A hath 30 cwt. of Prunes, at 6d. per lb. ready Money, but in Barter will have 71d. per lb. B hath Hops worth 36s. per cwt. ready Money; what ought B to rate his Hops in Barter, and what Quantity

must be given for the 30 cwt. of Prunes?

A hath Tea, at 8:. 6d. per lb. ready Money, but in Barter will have 10s. per lb. B hath Tobacco worth 18d. per lb. ready Money; how must B rate his Tobacco per lb. that his Profit may be equivalent with A's?

# QUESTIONS for Exercise at Leisure Hours.

A has Currants worth 41. per lb. but in Truck charges 6d. and also requires one-half of that in ready Money; B has Candles worth 6s. 8d. the Dozen, and he in Barter, honest Man, charges but 7s. Should these Persons deal together for the Value of 201. how much will A have got of B?

A lets B have a Hogshead of Sugar, Weight 18 c. worth 31s. for 42s. per cwt. one-third of which he is to pay in Cash; B hath Paper worth 14s. the Ream, which it is agreed shall bear no more than 15s. 6d. at that Rate and Truck for the rest; how stood the Ac-

counts ?

A has Kerseys, at 41. 5. a Piece, ready Money; in Barter they are charged by him at 51. 6s. each, and ½ of that required down; B has Flax at 3d. per lb. how ought he to rate it in Truck, not to be hurt by the Extortion of A.

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Change required 131. taking Wool, at 21. 6d. per Stone, of B in Return, that was really worth but 4. 2d. a Tod; the Question is, how many Sacks of Wool will pay for the Cloth, and which of the Dealers has the better in the Bargain?

9. A, with an Intention to clear 30 Guineas on a Bargain with B, rates Hops at 16d. per lb. that stood him in 10d. B, apprized of that, set down Malr, which cost 20. a Quarter, at an adequate Price; how much Malt did

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they contract for ?

10. A, in order to put off to B 720 Ells of damaged Holland, worth 51. an Ell, at 61. 8d. proposes, in Case has Half the Value in Money, to give B thereon a Discount of 10 per Cent. the rest A is to take out in Sas fron, which B, apprized of the whole Management rates in Justice at 301. the Pound; pray what was really worth in ready Money, and what Quantity of Sasfron was he to deliver on the Change?

in Barter he fets down at 10s. B, fenfible of this, he Pamphlets at 6d. a Piece ready Money, which he ade quately charges, and infifts, befides, on 4 of the Prior of those he parts with in Specie; what Number of the Books is he to deliver in Lieu of A's Paper, what Cal will make good the Difference, and how much is Bth

Gainer by this Affair?

12. A and B Barter; A has 140lb. 110z of Plate, at 61
4d. the Ounce, which in Truck he rates at 7s. 2d. a
Ounce, and allows a Discount on his Part, to have 70
that in ready Specie; B has Tea worth 9s. 6d. the li
which he rates at 11s. 2d. When they come to fink
the Balance, A received but 7 cwt. 2 qrs 18lb of Te
pray what Discount did A allow B, which of them ha
the Advantage, and how much, in an Article of Trad
thus circumstanced?

Hops, at 2/. 195. per cwt. but in Barter, insists on Guineas; B has Wine worth 6s. per Gallon, which raises in Proportion to A's Demand on the Balance; received but a Hogshead and a half of Wine; proportion to A's Demand on the Balance;

what had he in ready Money?

The

## 26. LOSS and GAIN

Is a Rule by which we discover the Gain or Loss by any arcel of Goods, and so instructs us how to raise or fall the ice of any Commodity, in such Proportion, that neither our ain may be so exorbitant as to injure our Customers, nor our offs so great as to impoverish ourselves; which is generally so much per Cent.

In this Rule there are great Variety of Examples, all of sich may be easily folved (with a little Consideration) by following Proportion.

When the Quantity lost and Gain of the Whole is given, find the Value of any Part thereof.

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Say, as the whole Quantity of Goods: is to the Sum of the ole Cost and proposed Gain:: so is any Part of said Goods: the Price they must be sold for.

When the proposed Gain or Loss is at so much per Cent.
Make 100 l. with the Gain or Loss added to it, your 2d.
rm.

# EXAMPLES.

Bought 240 Yards of Cloth, at 145. 6d. per Yard, and fold it again at 185. per Yard. What did I gain by the Whole?

what Rate must I sell it at per lb. to gain 12 Guineas by the Whole?

buy Tea, at 8 s 6 d. per lb. and sell it again for so s. 6 d. what is the Gain per Cent.

The five following Examples, in the Authors mentioned, i wrong answered; which is the Reason of my infert them here;—the Error confists in the stating the Que tion, by making the Gain or Loss of 100 L the 2d The instead of its Amount.

4. If, by felling Cloth at 5 s. per Ell, I gain 8 l. per Ca what shall I gain per Cent. if I fell the Ell at 6 s. 3 (Webster, 2d Ed. 32.)

4. At 5 s. per Dozen, I gain 7 l. 10 s. per Cent. how m shall I gain per Cent. if I sell the Dozen at 5 s. 9

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(Stonehouse, 2d Edit. P. 103.)

6. A Manchester Tradesman going to a Fair, sold Fust for 11s. 6 d. the End, wherein was gained 15 l. Cent. but seeing no other Tradesman, had so good, ra them, at the latter End of the Fair, to 12s. the End demand what he gained per Cent. by this last so (Hill, P. 289.)

7. Suppose I sell 500 Deals at 15 d. per Piece, and 91. Cent. Loss; what do I lose by the whole Quan

(Dilworth, 2d Ed. P. 73.)

8. Suppose I sell 1 cwt. of Hops for 6 l. 15 s. and gain per Cent. what would have been the Gain per Cent had sold them for 8 l. per Cent? (Walkingham, 3 F. 70.)

9. If by felling Hops at 3 l. 10 s. per cwt. the Planter 30 per Cent. what was his Gain per Cent. wh

fame Goods fold for 4 1. and a Crown?

10. Sold a Repeating-Watch for 50 Guineas, and by ing loft 17 per Cent. whereas I ought in dealing to cleared 20 per Cent. then how much was it fold the just Value?

# QUESTIONS for Exercise at leisure Hours.

31. If by fending Pewter to Turkey, and parting wi 35 \frac{2}{3} d. per lb. the Merchant clears Cent. per Centagoes he clear in Holland, where he disposes of for 8 l.

32. Bought Hose in London, at 41.3 d. the Pair, them afterwards in Dublin at 61. the Pair; nov

the Charges at an Average to be 2 d. the Pair, and confidering that I must lose 12 per Cent. by remitting my Money Home again, what do I gain per Cent. by this

Article of Trade?

If my Factor at Leghorn return me 800 Barrels of Anchovies, each we ghing 14 lb. Net, worth 12 1 d. per lb. in lieu of 7490 lb. of Virginia Tobacco, and if I find that I have gained after the Rate of 17 1. per Cent. by the faid Configument: Pray how was my faid Tobacco invoiced per lb. to the Factor, that is, what was the prime Cost?

Bought Comfits to the Value of 41 1. 3 s. 4 d. for 3 s. 1 d. per lb. it happened, that so many of them were damaged in Carriage, that by felling what remained good, at 45. 6d. per lb, my Returns were no more than 341. 2 s. 6 d. Pray how much of these Goods were spoiled, and what

did this Part stand me in?

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A Stationer fold Quills at 11 s. per Thousand, by which he cleared & of the Money; but they growing scarce, raised them to 13 s. 6 d. per Thousand: What might he

clear per Cent. by the latter Price?

A had 15 Pipes of-Malaga Wine, which he parted with to B at 4 1 per Cent. Profit, who fold them to C for 38 %. 111. 6 d. Advantage; C made them over to D for 500 % 16 s. 8 d. and cleared thereby 6 1 per Cent. what did

this Wine cost A per Gallon?

Laid out in a Lot of Muslin 480 l. 12 s. upon Examination of which, two Parts in feven proved damaged; that I could make but qs. 6 d. a Yard of the fame; and by fo doing find I loft 48 1. 18 s. by it, at what Rate per Ell am I to part with the undamaged Muslin, make up my faid Loss?

### 27. ALLIGATION MEDIAL

hen the Price and Quantity of feveral Commodities n to be mixed, to find the mean Price of that Mixbagamak ata

#### RULE.

As the whole Composition: is to its total Value: foil Part thereof; to its mean Price.

### PROOF.

Find the Value of the whole Mixture at the mean hand if it agrees with the total Value of the several Quaties at their respective Prices, the Work is right.

### EXAMPLE 8.

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thel, with 20 Bushels of Rye, at 3 s. per Bushel, as Bushels of Barley, at 2 s. per Bushel. What will a shel of this Mixture be worth?

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Bush.	1 1 5. 5.	then, bu. 1. If 40:148
Firft 12 multiplied	by its Price 6=72	Tailed the state of
And zo -	by 3=60	-303 - 130 s <del>20</del>
Alfo 8	by 2=16	40)14 8
ald them to Cor 38 t	1 odw 11 11 11 11 11 11 11 11 11 11 11 11 11	130 1 1 1 1 1 1 1
Sum 40	Sum 148	Rem. 28
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Ans. 3 s. 8 \ d. 24 per Bushel

Rem. 16

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reflected his ed a second so that it bad good bit

2. A Wine-Merchant mingles 14 Gallons of Mountain at 8. per Gallon, with 12 Gallons at 6. per Gallons of Sherry at 7. per Gallon, 20 Gallons of White Wine at 4. per Gallon, and 8 Gallons of ry at 9. per Gallon: How may he fell this M per Gallon?

Grocer mingled 20 lb. of Tea, at 12 s. per lb. with 12 lb. at 8 s. 16 lb. at 6 s. and 12 lb. at 4 s. per lb. together; I demand the Price of 1 lb. of this Mixture.

Mint-Master hath 4 lb. of Gold of 22 Carracts fine, 3 lb. of 20 Carracts fine, and 3 lb. of 18 Carracts fine: I demand what Fineness 1 lb. of this Mass shall be when mixt together?

With 13 Gallons of Canary, at 6 s. 8 d. a Gallon, I mingled 20 Gallons of White Wine, at 5 s. a Gallon; and to these added 10 Gallons of Cyder at 3 s. a Gallon, at what Rate must I sell a Quart of this Mixture, so as to clear 10 per Cent?

### 8. ALLIGATION ALTERNATE

when the Rates of feveral Commodities are given to such Quantities of them, as being mixed together shall a Price propounded.

### RULE.

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he Rates (if not already) must all be reduced to one Denomination.

another, and the mixed or mean Rate on the left Hand of these.

onnect or link together the several Rates, so that every one less than the mean, be linked with some one greater, or with as many as you please, that are greater, and every great with one less, or with as many less as you please

ake the Difference between each Price and the mean Rate, and let them alternately, and if only one Difference standagainst any Rate, it will be the Quantity belonging to that said Rate; but if there are several, then their Sum will be the Quantity, which Quantities are the Answer for that Rate, against which they stand.

Pake the Difference between each Peter and the sealth

### EXAMPLES.

1. A Grocer would mix Raifins of the Sun at 8d. per with Malaga at 5d. and Smyrnas at 4d. per lb. I de to know what Quantity of each Sort he must take, that the Mixture may be worth 6d. per lb.

Proof 6d.

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another at 4s. the third at 4s. 6d. and the fourth at per Bushel. But he is desirous of mixing so much each Sort together, that he may fell it at 5s. per Bushe How much of each Sort must he take?

3. To mix Gold of 18 Carracts fine with that of 23 Carrafts, of 19, and of 16 Carracts fine, fo that the Compation may be 20 Carracts fine; what Quantity of a

most be taken?

4. A Grocer would mix a Quantity of Sugar at 10d. per with other Sugars 72d. 5d. and 42d. per lb. intend to make up a Commodity worth 6d. per lb. In we Proportion is he to take of those Sugars?

### 29. ALLIGATION PARTIAL

Is when the Price of each Simple is given, also the Quantities of the Rest in Proportion to that given.

#### RULE.

Rate as in the last Rule.

As the Difference of that Simple, whose Quantity is given: is to the known Quantity: fo is any other Difference: to the Quantity of its opposite Name.

### EXAMPLES.

A Farmer being determined to mix 12 Bushels of Wheat at 6s. per Bushel, with Rye at 4s. Barley at 3s. and Oats at 2s. 6d. per Bushel: I demand how much Rye, Barley, and Oats, must be mixed with the said 12 Bushels of Wheat, so that the Whole may be sold for 3s. 6d. per Bushel?

### PROOF.

$$\begin{cases}
bu. \\
24 \\
60 \\
12
\end{cases}$$
at
$$\begin{cases}
72 = 864 \\
48 = 1152 \\
36 = 2160 \\
30 = 360
\end{cases}$$
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108 : 4536:: 1: 42d. the mean Rate given.

A Vintner intends to mix 28 Gallons of Wine at 7s. per Gallon with others, at 4s. 6s. 6d. and 8s. per Gallon; what Quantity of each must be take with the 28 Gallons, so that the Composition may be sold at 6s. per Gallon?

How much Tea at 6s. 6d. 7s. 6d. and 9s. per lb. must be taken to be mixed with 36lb at 12s. per lb. that the

Mixture may be worth 8s. per 1b.?

A Tobacconist has by him 120lb. of fine Oroonoko Tobacco worth 2s. 6d. a Pound; to this he would mix York-River ditto at 20d. and other inferior Tobaccos at 18d. and 15d. a Pound, as will make up a Mixture answerable to 2s. a Pound: what will this Parcel weigh?

N

### 30. ALLIGATION TOTAL

Is when the Price of each Simple is given, as also to mean Rate, and what Quantity of the Compound, to fin how much of each Sort will make that Quantity.

#### RULE.

- 1. Take the Difference between each Price, and the mea
- 2. Say, As the Sum of these Differences: is to the who Quantity of the Mixture: so is each particular Difference: to its particular Quantity.

#### EXAMPLES.

9. A Brewer hath 3 Sorts of Beer, viz.-at \$d. 12d. and 16 per Gallon, which he would make a Mixture of Gallons with, worth 10d. per Gallon: How much each Sort must be taken?

1 ft. d. 2 dly. diff. gal. d.

d. 
$$\begin{cases} 8 \\ 10 \\ 16 \end{cases} = \begin{cases} 2 \\ --- \\ --- \\ 2 \end{cases}$$
 As 12:48:  $\begin{cases} 8 : 32 \\ 2 : 8 \\ 2 : 8 \end{cases}$  at  $\begin{cases} 8 \\ 12 \\ 16 \end{cases}$  per  $\begin{cases} 12 \\ 16 \end{cases}$  the  $\begin{cases} 8 : 32 \\ 12 : 8 \end{cases}$  Sum 12

48 the whole Quanti

### PROOF.

As 48 Gal.: 480d. the Value of the Mixture::16; 10d. the mean Price given.

8d. per lb. and he would have a Composition of a worth 6d. per lb. so would be glad to know what Que tity of each Sort he must take?

be mixed together, to form a Composition of 60 04 20 Carracts fine?

12. A Druggist has by him 4 Sorts of Green Tea, viz. 65. 85. and 95. per. 1b. out of these he is inclined to up a Canister, containing Net a Hundred and a

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As erling ote, fo as to make the Commodity worth 7s. the Pound. In what Proportion must those Teas be taken?

### 31. EXCHANGE

Is the receiving in one Country for the Value paid in nother.

The Par of Exchange is always fixed and certain, it being the intrinsic Value of any foreign Money compared with terling, but the Course of Exchange between any two Coun-

ies rifes and falls upon various Occasions.

But as it would be both needless and endless to write of very Kind of Exchange; so I shall only give a few Exam-les of the Exchange of England with some of the chief countries of Europe.

Exchange is either performed by Sect. 12 or 17, and some-

mes most expeditious by the latter.

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#### Ift. With FRANCE.

They keep their Accounts at Paris, Lyons, and Rouen, in ivres, Sols, and Deniers, and exchange by the Crown of ree Livres, Tournois, or 60 Sols French, and give Pence, terling, more or less, for this Exchange Crown, which is the total to 41. 6d. at Par.

20 Sols make one Crown.

1. To change French Money into Sterling,

### RULE.

As 1 Crown: is to the given Rate:: fo is the given French in: to the Sterling required; or by the Rules given in tallice.

2. To change Sterling Money into French.

#### R.U L E.

As the Rate of Exchange: is to 1 Crown:: so is the erling Sum: to the French required.

ote, The fame Rule must be observed with most of the following Countries.

N 2

EXAMPLES.

### EXAMPLES.

2. What Sterling Money must be paid in London, to receive in Paris 500 Crowns; Exchange at 56d. per Crown?

As 1:56::500 thus 500 at 4s. 8d.

Ans. 28000d.=116l. 13s. 4d. 100,0

8d. is \( \frac{1}{6} \)
Anf. \( \frac{1}{6} \). 116 13 4 as before

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2. How many Crowns must be paid at Paris, to receive in London 1161. 13 s. 4 d. the Exchange at 56 d. po Crown?

As 56: 1::116 13 4=28000d.  $56 \begin{cases} 7 \\ 8 \end{cases} \frac{28000}{4000}$ 

Anf. 500 Crowns

3. Change 640 Crowns, 12 Sols, 8 Deniers, at 54 4 P. Crown into Sterling?

4. Change 1451. 71. 7 ½d. Sterling into French Crowns, El change at 54½d. per Crown?

#### 2d. With SPAIN.

They keep their Accounts at Madrid, Cadiz, and Sevil in Dollars, Rials, and Maravedies, and exchange by the Pio of Eight, which is equal to 41. 6d. at Par.

4 Maravedis Vellon, or 3 25 Maravedis Plate 8½ Quartas, or

34 Maravedis Vellon

16 Quartas, or

34 Maravedis Plate 8 Rials of Plate Quartas.

make one Rial Vellon.

Rial of Plate.

Piece of & or Dol

B. A Rial Vellon is  $\frac{17}{32}$  of a Rial of Plate, and  $\frac{17}{250}$  of a Piaster.

#### EXAMPLES.

Change 8561. 6s. 8d. into Spanish Money, Exchange at 56d, per Piece of Eight?

If I pay in Seville 1426 Pieces of \(\frac{8}{8}\), 4 Rials, 26 Maravedis, what may I draw my Bill for at London, Exchange at 54\frac{1}{3}d. per Piece of \(\frac{8}{8}\)?

### 3d. I T A L Y.

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In Italy they keep their Accounts at Genoa and Leghorn, Livres, Sols, and Deniers, and exchange by the Piece of ight or Dollar, which is equal to 4s. 6d. at Par.

Deniers
20 Sols
5 Livres
6 Livres
Piece of 8 at Cenoa.
Leghorn.

t Florence the Exchange is by Ducatoons, and at Venice by Ducats, divided as follows, viz.

6 Solidi 24 Groffes make one Crofs. Ducat.

#### EXAMPLES.

Genoa is indebted to London 640 Dollars, for how much Sterling may London Value on Genoa, the Exchange at 52d. per Dollar?

If a Merchant remits 1381. 135. 4d. Sterling to Leghorn, how many Dollars will he receive there, the Exchange at 52d. per Dollar?

Note, in St. George's Bank at Genoa, Accounts are kept in Piasters or Pezzoes, which are divided into Solidi and Denarii, as the Pound Sterling.

But some Merchants keep their Accounts in Lires, or Liras, Solide, and Denare, divided, as before; this Money is only one Fifth in Value of the Bank-Money.

N 3

9. Change 8644 Pez. 2s. 6d. into Sterling Money, exchange

at 47 2d. per Pezzoe?

10. London is indebted to Genoa in 1710l. 16s. 4d. for how many Pezzoes may Genoa value on London, the Exchange at 47½d. per Pez.?

### 4th. With PORTUGAL.

They keep their Accounts in Lisbon, Oporto, &c. in Reas, and Exchange on the Milrea, which London gire from 51. to 51. 6d. for the same.

400 Reas make one Crusadoe. Milrea.

### EXAMPLES.

11. A Merchant at Lisbon, being desirous to remit to his Correspondent in London 4760 Milreas, Exchange a 64d. per Milrea, how much Sterling must be paid in London?

12. How many Milreas will 1566l. 6s. 8d. amount to, E

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change at 64d. per Milrea?

### 5th. With HOLLAND, FLANDERS, and GERMAN

In these Places their Accounts are kept sometimes in Pounds, Shillings, and Pence, as in England, and sometime in Guilders, Stivers, and Pennings. The Money of Holand and Flanders is distinguished by the Name of Flemish and the Exchange is made with London, from 30 to 38 Shillings Flemish, per £. Sterling.

As a sected	Groat.
	Stiver.
	Shilling.
make one	Florin, or Guilder.
17.75	Rix Dollar.
	Pound Flemish.
	Ducat.
	make one

To change Flemish Money into Sterling; and, on a contrary, Sterling into Flemish, is the same with that France, only what was French there will be Flemish here.

To reduce Flemish Pounds, Shillings, and Pence, into uilders.

#### RULE.

Reduce them into Pence Flemish, then divide by 40, because 40d. is equal to one Guilder) and the Quotient ill be Guilders; and the Remainder (if any) divide by 2, because 2d. is equal to one Stiver) and the Quotient will be tivers.

### EXAMPLES.

ish, to be paid in London, how much Sterling Money must he draw for Exchange at 34s. 4d. per £. Sterling?

Suppose a Merchant delivered in London 3281. 16s.

113d. to receive the Value at Amsterdam in Flemish
Money; how many Pounds must be receive there, the
Exchange at 34s. 4d. Flemish per £. Sterling?

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What may I draw my Bill for to London, if I pay in Antwerp 4200 Guilders, 12 Stivers, 8 Pennings, Exchange at 335. 3d Flem. per L. Sterling?

If I pay in London 4211. 25. 3d. how many Guilders may I draw my Bill for to Antwerp, Exchange at 335. 3d. Flem. per £. Sterling?

Exchange 2421. 13s. 6d. Flemish into Guilders, Stivers, &c.

## th. To Change CURRENT MONEY into BANCO.

### RULE.

As 100 with the Agio added to it: is to 100 Banco:: so any given Sum current: to the Banco required.

### EXAMPLE.

Change 495 Guilders, 18 Stivers Current, into Banco Florins, Agio 5 per Cent.

To change Banco into Current Money.

### RULE.

Is 100 Guilders Banco: is to 100 with the Agio added
1: : so is the Banco given: to the Current required.

### EXAMPLE.

Pg. Change 470 Guilders, 8 Stivers Banco, into Current

Agio at 58 per Cent?

Note, The Bank Money is worth more than the Current, their Difference is called Agio, and is from 3 to per Cent. in Favour of the Bank.

# 7th. With VENICE.

Money of Exchange here is always understood to be the of Ducats in Bank, which is imaginary, 100 whereof make 120 Ducats Current Money; so that the Difference betwin Bank and Current Money is an Agio of 20 per Cent. the Brokers have invented another Agio to be added, which is more or less, according to Bargain.

The Course of Exchange of a Ducat of the Bank of Vi

nice is from 45 to 50d. sterling.

### EXAMPLE.

20. Venice draws on London for 4700 Ducats, 10 Sols, den. Banco, Exchange at 47 g per Ducat, how must Sterling will pay Draught?

### 8th. With POLAND and PRUSSIA.

Dantzick and Koningsberg Exchange with London Way of Amsterdam and Hamburgh; 270 Polish Grobbeing=11. Gross Banco in Holland, 110 Polish Grobbeing=1 Rix-Dollar, Banco of Hamburgh.

18 Phenningen		Grosch.
3 Grosch		Ditkin
2 Ditkins	B	Sixer
3 Sixers	ak	Tymph
7½ Grosch		Arch de Halber
4 Arch de Halbers	ne	Florin or Gilder.
3 Florins or Gilders		Current 3 Dollar.
4 Gilder		Specie Sponal.

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### EXAMPLES.

Change 4684 Florins into Sterling Money, 270 Groschi Poli, per Pound Flemish, and 34s. 4d. Flemish, per Landsterling?

Change 3901. Sterling into Florins, the Exchange being 331. 4d. Flemish, per £. Sterling, and 270 Groschi

Poli, per L. Flemish?

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### 9th. With RUSSIA.

3 Copecs	).	Altine.
10 Copecs		Grievener.
25 Copecs	males one	Polpoliton.
2 Polpolitons	make one	Poltin.
2 Poltins	Paras Maur	Rubble.
2 Rubbles	j marna ge	Ducat.

The Russian Rubbles are converted into Florins Current, mey of Amsterdam, and the Current into Bank Money, ording to Agio of three or five per Cent. and Bank mey into Sterling, according to the Agio of three or per Cent. and Bank Money into Sterling, according the Course of Exchange between England and Amster-

### EXAMPLE.

In 6420 Rubbles, 42 Copecs, Exchange 122 Copecs per Rix-Dollar current, Agio 3 per Cent. and 341. 6d. Flemish, per L. Sterling, how much Sterling Money?

### 10th. With I R E L A N D.

In Ireland they keep their Accounts in £. s. and d. Irish, ided as in England; but having no Coins of their own, y are supplied by the different Countries with which they fic.

The Par of Exchange between England and Ireland is of Sterling for 1081. 6s. 8d. Irish, or 1s. English = 13d. The Course of Exchange is from 5 to 12 per Cent. acting to the Balance of Trade.

### EXAMPLES.

24. Dublin draws upon London for 7401. 141, 6d. Irifh, En change at 12 per Cent. how much Sterling mult London pay Dublin to discharge this Bill.

25. London remits to Ireland 6511. 145. 113d. Sterling how much Irish must London be credited, Exchanges

12 per Cent?

### 11th. With AMERICA and the WEST-INDIES.

In Exchange with our Colonies in America and the Well Indies, Accounts are kept, and the Money divided, asi

England; their Money is called Currency.

The Scarcity of Cash obliges them to substitute a Par Currency for carrying on their Trade; which being substitute a Very great Discount for Sterling, in the Purchase of Bills of Exchange.

### EXAMPLES.

26. Philadelphia is indebted to London 14741. 161. cum cy, what Sterling may London reckon to be remitted when the Exchange is 64 per Cent?

for 9431. 171. 54d. Sterling; for how much Current was London indebted, Exchange being at 64.

Cent. ?

28. London configns to Jamaica Goods, per Invoice, mounting to 6 tol. 16s. 9d. which are fold for 987l. 12 Currency; what Sterling ought the Factor to rem deducting 5 per Cent. for Commission and Charge and what does London gain per Cent. upon the Adve ture, supposing the Exchange at 30 per Cent.?

29. Jamaica is indebted to London 14701. 125. 8d. Sterlin with how much Currency will London be credited Jamaica, when the Exchange is 36½ per Cent?

### A few Examples for Exercise in this Rule.

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30. Amsterdam changes on London 34s. 4d. per £. 8t ling, and on Lisbon at 52d. Flemish, for 400 Re

how then ought the Exchange to go between London and Lisbon?

A at Paris draws on B of London 1200 Crowns, at 55d. Sterling per Crown; for the Value whereof B draws again on A 56d. Sterling per Crown, besides Commission 1 per Cent. Did A get or lose by this

Transaction, and what?

V of Amsterdam draws on X of Hamburgh, at 67d. Flem. per Dollar, of 32 Sols Lubeck; and on Y of Nuremberg, at 70d. Flemish per Florin, of 65 Crutzers Current: If V has Orders to draw on X in order to remit to Y at the faid Prices, how would run the Ex-

change between Hamburgh and Nuremberg?

M of Amsterdam orders N of London to remit O of Paris at 54d. Sterling per Crown, and to draw on P of Antwerp for the Value, at 31/25. Flem. per f. Sterling; but as foon as N received the Commission, the Exchange was on Paris, at 54d2. per Crown; pray at what Rate of Exchange ought N to draw on P to execute his Orders, and be no Lofer?

London changes with Amsterdam on Par at 335. 4d. Flem. per f. Amsterdam changes on Middleburg, at 2 per Cent. How stands the Exchange between London

and Middleburg?

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Q of Rotterdam remits to R of Paris 2000 Crowns, at 91d. Flem. per Crown, and double Usance, or two Months, and pays 20 per Cent. Brokerage, with Orders to remit him again the Value, at 93d. per Crown, allowing at the same Time 1 per Cent. for Provision: what is gained per Cent. per Annum, by a Remittance

thus managed?

A of Amsterdam owes B of Paris 2000 Florins of current Specie, which he is to remit him, by Order, the the Exchange at 902d. Flemish per Crown, of 60 Sols Tournois, the Agio of the Bank being four per Cent. better than Specie; but this, when it was to be negociated the Exchange was down at 891d. per Crown, and the Agio raised to five per Cent. what did B get by this Turn of Affairs?

32. Com-

32. Comparison of WEIGHTS and MEASURES,

Is when the Weights or Measures of different Countains are compared together, and is a very necessary Rule great Importance to the Merchant) to be acquainted with

### CASE I.

When it is required to find how many of the first Son Weight or Measure mentioned in the Question) are equ a given Quantity of the last.

### RULE.

1. Place the Numbers alternately beginning at the Hand, and let the last Number stand on the Hand.

2. Multiply the first Rank continually together for all

dend, and the second for a Divisor.

### EXAMPLES.

and 100lb. at Marfeilles are equal to 113lb. of Marfeilles are equal to 81lb. of flerdam; how many Pounds at London are equal to 60lb. of Amsterdam?

Left-hand. Right-hand.

1st. 100 113 2d.  $100 \times 100 \times 60 = 600000$  Divide 100 81 113  $\times 81 = 9153$  Divide 60 — 9153)600000(65lb. 8 oz.  $\frac{7656}{9153}$ 

2. If 104lb. of English are equal to  $84\frac{1}{2}$ lb. of Geneva, 100 lb. of Geneva are equal to 108 lb. at Ro how many Pounds English are equal to 64lb Rouen?

3. Suppose 100 Yards English to be equal to 78 Ells Fit and 133 Ells at Amsterdam; how many Yards En

are equal to 100 Ells at Amfterdam?

4. If 100 Canes of Genoa be equal to 1913 Ells of land, and 78 Ells of Eng. be equal to 1313 of Bin how many Canes of Genoa are equal to 100 B Brussels?

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#### CASE II.

When it is required to find how many of the last Sort (of eight or Measure mentioned) are equal to a given Numof the first.

#### RULE.

Place the Numbers alternately, beginning at the left Hand (as before), and fet the last Number on the right Hand.

Multiply the first Row for a Divisor, and the other for a Dividend.

#### EXAMPLES.

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100 B

Suppose 100lb. of Portugal be equal to 92lb. of Antwerp, and 100lb. of Antwerp, be equal to 110lb. of Lyons; how many Pounds at Lyons are equal to 60lb. of Portugal?

f 74 Yds. of Engl. be equal to 100 Brasses of Florence, and 100 Brasses of Florence be equal to 30 Canes of Marseilles; how many Canes of Marseilles are equal to 100 Yards English?

### POSITION,

O R,

### The RULE of FALSE,

so called, because we suppose some uncertain or false thers, in order that by reasoning from them, according to Nature thereof, do, by those salse supposed Numbers, the true Number sought.

Rule is divided into two Parts, commonly called the Single Rule and Double Rule.

### SINGLE POSITION.

Single Position are answered all such Questions, as reonly one Supposition to discover the true Result.

RULE.

# RULE.

Make choice of your Position, work with that Supposition according to the Nature of the Question, as if it were true Number, and if you find (after ordering your Position the result either too much or too little, you may then find true Answer, by this Proportion, viz.

As the Result of your Position : is to the Position :: 6

the given Number: to the Number fought.

#### PROOF.

Add the several Parts of the Sum together, and if the Su agrees with the given Number it is right.

#### EXAMPLES.

Ages, says B to A, I am as old and half again as old you; then says C to B, I am twice as old as you; in says A to them both, I am sure, if our Ages be add together, the Sum will be 132. I demand each Ma Age.

Suppose A's to be 20 If 110: 20:: 132 then B's will be 20+10=30 and C's 30×2=60

Refult 110

24 A's ag then 24+12=36 B's and 36×2=72 C's

Sum 132 Proof.

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2. A Man, overtaking a Maid driving a Flock of Ge faid to her, How do you do, Sweetheart? Where you going with these 40 Geese? No, Sir, said she have not forty, but if I had as many more, half as m more, and 10 Geese besides, I should have 40. I many Geese had she?

A, B, C, and D, were in Company together; A told C, that he was older than him by 4 Years; B told them, that he was as old as both of them together, and 9 Years older; D, hearing them, faid, I am just 45 Years old, and that is equal to the Sum of your Ages added together. How old was each of them added together?

How old was each of them severally?

Three Persons, viz. Andrew, Benjamin, and Christopher, are to go a Journey of 469 Miles; of this Journey Andrew is to go a certain Number of Miles unknown; Benjamin is to go three Times as many Miles as Andrew and one League more; and Christopher is to go twice as many Miles as Benjamin and 16 Miles more. How many Miles must each of these Persons travel severally?

Admit three Merchants, A, B, and C, to build a Ship, which cost them 2000l. of which A pays a certain Part unknown; B paid 3 \frac{1}{2} as much, wanting 45l. 15s. and C paid as much as both A, B together and 26l. 10s.

more. How much did each Person pay?

I have a Cistern, with three unequal Cocks, containing 60 Pipes of Water, the greater Cock will empty the Cistern in one Hour, the second in two, and the third in three. In what Time will they empty the Cistern, supposing they all be set open at once?

A General being asked the Number of Men his Army consisted of, answered, that \( \frac{3}{4} \) of \( \frac{1}{2} \) amounted to 900.

What Number of Men had he?

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A young Gentleman, at the Age of 2r Years, was told by his Guardian, that his Fortune confisted in Cash to the Amount of 7400l. and that his Father died when he was but 10 Years old, and the Money your Father lest, said the Guardian, I have allowed you 5 per Cent. per Ann. for, simple Interest, only I have deducted 100l. per Ann. for your Education, &c. What was the Son's Fortune that was lest by the Father?

A Schoolmaster was asked how many Scholars he had, answered, if I had as many, ½ as many, ½ as many, and ¼ as many, I should have 333. How many had he?

### 34. DOUBLE POSITION

Is when two Suppositions are used; and if we miss in both (as it generally happens) observe the Nature of the Enters, whether they be greater or less than the given Number and accordingly they must be made use of thus.

#### RULE.

1. Place the Error against its respective Position, and multi

ply them cross-wife.

2. If the Errors are alike, that is, both greater, or both less than the given Number, take their Difference for a Dividend visor, and the Difference of their Products for a Dividend

But if unlike, that is, one too much and the other too little then take their Sum for a Divisor, and the Sum of the Products for a Dividend, the Quotient will be the Answer

#### EXAMPLES.

Saddle worth 501. which if fet on the Back of the in Horse will make his Value double that of the second but if set on the Back of the fecond Horse makes have triple that of the first Horse. I demand the Value of each Horse.

Suppose the Value of the first Horse to be 20 To which add the Value of the Saddle 50

2)70 Double the Value

of the Second.

Then the Value of the fecond is

To which add the Value of the Saddle 50

The Sum should have been triple the
Value of the first Horse

Again, Suppose the first Horse to be worth 24

Then proceeding as above

2)74

Also the Value of the second is 37

50 87=15 too much

Su

t

Then 25-15=10 Difference of Errors.

Also 600-300=300 Difference of the Prod.

300 in 300 to=30 the Value of the first Horse.

1. 30 Value of the first Horse. 50 Value of the Saddle.

2)80 Double the Value of the fecond Horse.

£.40 Value of the second Horse.
50 Value of the Saddle.

Proof 90=30+3=90

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Double my Money for me said A to B, and I will give thee 6d. out of the Stock; with the Remainder he applied in the like Manner to C with equal Success, and gave him also 6d. he repeated this Proposal to D, and then 6d. was all he had to give. Pray, what Sum had he to begin with?

Three Gentlemen, A, B, and C, playing at Hazard together, the Money staked 112 Guineas, but disagreeing, each seized as many as he could; A got a certain Quantity, B as many as A and 16 more, but C got only 1 6th Part of both their Sums, how many had each?

A Boy stealing Apples was taken by Mad Tom, and to appease him gives half he had, and Tom gives him back 10; in his Return home was met by Raving Ned, who took from him one Half of what he had lest, and gave him back 4; after that, unlucky Positive Jack meets him, when he gave him one Half of what he had lest, and he returns him back 1; at last getting safe away he finds he has 18 lest. How many had he at first?

A Son asked his Father how old he was; his Father replied, Your Age is now \(\frac{1}{5}\) of mine; but 4 Years ago, your Age was only \(\frac{1}{7}\) of what mine is now. What were their Ages?

There is a certain Fish, whose Head is nine Inches long, the Tail as long as the Head and Half the Body, and the Body is as long as both the Head and the Tail. demand the whole Length of the faid Fish.

16. To find a Number, which if added to itself and the Sun multiplied by the same, and the same Number still sub-stracted from the Product; and lastly the Remainder divided by the same, that it may produce 13.

17. When first the Marriage-Knot was ty'd
Betwixt my Wife and me,
My Age did her's as far exceed
As three Times three doth three;
But when ten Years and Half ten Years,
We Man and Wife had been,

Her Age came up as near to mine.
As eight is to fixteen.

Now tell me, I pray,

What were our Ages on the Wedding-Day?

18. A Gentleman finding several Beggars at his Door, gate to each Four-Pence, and had Sixteen-Pence left; but he had given to each Six-Pence, he would have wanted Twelve-Pence. How many Beggars were there?

Both Money and Time, went to drink with his Friends
He said to his Host, if you'll now to me lend
As much Coin as I have, then my Six-pence I'll spend
His Host lent the Money, his Six-pence he spent;
And, having so done, to another House went;
Where the same he requested, and the same Sum he spent:

He went to a third House, where, Landlord, crieshe, Lend me as much Money as here you see\*; Which having received, his Six-pence he spent, So all being gone, home the Fuddle-Cap went, To cast up his Reckonings; but his Head aching sore, He begs you to do it, and he'll do so no more. What had he at first, and how much on score?

A

N

A

P

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be

H

\* Shewing what he had left.

20. To find a Number, which being multiplied by 3, fab tract 5 from the Product; and the Remainder divided by 2, if the Number fought be added to the Quotient, the the Sum may be 40. I. Two Companions have got a Parcel of Guineas; fays A to B, if you will give me one of your Guineas, I shall have as many as you will have left; Nay, replies B, if you will give me one of your Guineas, I shall have twice as many as you will have left. How many Guineas had each of them?

. A Son asked his Father, how old he was? his Father anfwered him thus: If you take away 5 from my Years, and divide the Remainder by 8, the Quotient will be 1 of your Age; but if you add 2 to your Age, and multiply the Whole by 3, and then subtract 7 from the Pro. duct, you will have the Number of the Years of my Age. What was the Age of the Father and Son?

Two Men have a mind to purchase a House rated at 12001. fays A to B, if you give me 2 of your Money, I can purchase the House alone; but says B to A, if you will give me 3 of yours, I shall be able to purchase the

House. How much Money had each of them?

Suppose the Number 50 were to be divided into two Parts, fo the greater Part being divided by 7, and the lesser multiplied by three, the Sum of this Product, and the former Quotient may make the same Number pro-

posed, which was 50.

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A certain man hires a Labourer on this Condition, that for every Day he worked he should receive 12 Pence. but for every Day he was idle, he should be mulcted 8 Pence: When 300 Days were past, neither of them were indebted to one another. How many Days did he work, and how many was he idle?

A Person being asked how old he was, answered, if I quadruple 3 of my Years, and add 1 of them + 50 to the Product, the Sum will be so much above 100 as the

Number of my Years is now below 100.

A certain Person bought two Horses, with the Trappings which cost 100l. which Trappings if laid on the first Horse A, both the Horses will be of equal Value; but if the Trappings be laid on the other Horse, he will be double the Value of the first. How much did the Horses cost?

# 35. PROGRESSION

Consists of two Parts,

# ARITHMETICAL and GEOMETRICAL

## ARITHMETICAL PROGRESSION

Is when a Rank or Series of Numbers increase or decrease by a common Difference, or by a continual adding or subtracting some equal Numbers.

As { 1,2,3,4,5,6,7,8. } Here the common Difference is 1. 8,7,6,5,4,3,2,1. } Here the common Difference is 2. Also 35,30,25,20,15,10,5. Here the common Difference is 3.

when the Number of Terms are even, as 1,3,5,7,9,11 or the like, the Sum of the two Extremes will be equal to the Sum of any two Means that are equally diffus from the Extremes.

viz. 1,3,5,7,9,11. 1+11=5+7=5+9=12. A

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2. When the Number of Terms are odd, as 2, 4, 6, 8, 10 the Double of the middle Figure or Term will be equal to the Sum of the Extremes, or to any two Means equally distant from the middle Term.

viz. 2,4,6,8,10.  $6 \times 2 = 4 + 8 = 2 + 10 = 12$ .

In Arithmetic Progression there are five Things to be of ferved, viz.

1. The first Term.

2. The last Term.

3. The Number of Terms.

4. The common Excess or Difference.

5. The Aggregate or Sum of all the Terms.

Any three of which being given, the other two may found.

#### PROPOSITION I.

When the two Extremes and the Number of Terms given, to find the Sum of all the Series or Terms.

#### RULE.

Multiply the Sum of the two Extremes into the Number Terms, and divide the Product by 2. The Quotient will the Sum of all the Series, or multiply the Sum of the two greenes by Half the Number of Terms.

### EXAMPLES.

How many Strokes do the Clocks at Venice (which go on to 24 o'Clock) strike in the Compass of a natural Day?

24=25 the Sum of the Extremes.

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6+4=24 the Number of Terms.

or thus
1+24=25 Sum of the Extremes
12 Half the Number of Terms
Ans. 300 Strokes, as before.

How many Strokes does the Hammer of a Clock strike in

The Length of my Garden is 94 Feet; now if Eggs be laid along the Pavement a Foot asunder, and be setched up singly to a Basket, removed one Foot from the first, how much Ground does he traverse that does it?

Suppose 100 Stones were placed in a right Line, a Yard distant from one another, and the first Stone were a Yard from a Basket; I demand how many Miles he must travel that gathers them singly into the Basket?

A Butcher buys 100 Sheep, and gave for the first Sheep
13. and for the last 91. 193, I demand what he gave for
the 100 Sheep?

### PROPOSITION II.

When the two Extremes and Number of Terms are en, to find the common Difference.

RULE.

#### RULE.

The Difference of the two Extremes divided by the Number of Terms less an Unity or 1, the Quotient will be a common Difference.

#### EXAMPLES.

6. One had 20 Children that differed alike in their Age
the youngest was 5 Years old, the eldest 43, what we
the Difference of their Ages, and the Age of each!
Here 43—5=28, the Difference of the Extremes,
And 20—1=19, the Number of Terms less 1.
Also 38:19=2, the common Difference.

Which add to the Age of the youngest, and so on con nually to the rest, will give their several Ages, viz.

5+2=7 the Age of the 2d.

And 7+2=9 the Age of the 3d, and so on for the reft.

7. A running Footman (for a Wager) is to travel for London to a certain Place Northwards, in 19 Day and to go but 6 Miles the first Day, increasing end Day's Journey by an equal Excess, so that the last Day Journey may be 60 Miles: I demand each Day's Journey, and the Distance of the Place he goes to is so London?

8. A Debt is to be discharged at 10 different Payments
Arithmetical Progression; the first Payment is to be
and the last 501. What is the whole Debt, and w

must each Payment be?

### PROPORTION III.

When the two Extremes and the common Difference given to find the Number of Terms.

### RULE.

Divide the Difference of the two Extremes by the commences or Difference, add Unity or 1 to the Quotient, the Sum will be the Number of Terms.

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#### EXAMPLES.

A Man being asked how many Children he had, answered, my youngest Child is 5 Years old, and the eldest 43, and that he had increased one in his Family every two Years; how many Children had he?

First 43-5=38 the Difference of the Extremes.

Then 38-2=19 and 19+1=20 Children the Answer.

A Person travelling from London Northward, went 6
Miles the first Day, and increased every Day's Journey

3 Miles, till at last he went 60 Miles in one Day: how
many Days did he travel?

#### PROPOSITION IV.

When the last Term, the common Difference, and the imber of Terms are given, to find the first Term.

#### RULE.

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Multiply the Number of Terms less Unity or 1, by the nmon Difference, the Product subtracted from the last rm leaves the first.

### EXAMPLES.

A Man in 19 Days went from London to a certain Place in the Country, every Day's Journey was greater than the preceding one by 3 Miles, his last Day's Journey was 60 Miles, what was the first?

First 19-1=18 the Number of less 1.

3 Common Excess

Then 60—54=6 the first Day's Journey. Q. E. F. A Person takes out of his Pocket, at 10 different Times, so many different Number of Guineas, every one exceeding the former by two, the last was 23, what was the first?

### PROPOSITION V.

When the Number of Terms, common Difference, and Sum of all the Terms are given, to find the first Term.

# Arithmetical Proportion.

### R U L E.

Divide the Sum of all the Series by the Number of Ten and from that Quotient subtract Half the Product of a common Difference, multiplied by the Number of Ten less one, gives the first Term.

### EXAMPLES.

13. A Person is to receive 2751. at 10 different Paymen each Payment to exceed the former by 51. he is will to bestow the first Payment on any one that can tell what it is; what must the Arithmetician have for Pains?

First 275-10=271. 10s.

And 10-1=9. also  $9\times 5=45$ , which  $\frac{1}{2}=22l$ . 104

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Then 271. 10s.-221. 10s.=51. Q. E. F.

14. Suppose it is 100 Leagues between London and Edburgh, two Couriers set out from each Place on same Road; that from London towards Edinburght velling every Day two Leagues more than the Day fore; that from Edinburgh to set off one Day and the other travelling every Day three Leagues more the preceding one, and that they meet exactly way, the first at the End of sive Days, and the at the End of sor; how many Leagues did each to each Day?

### PROPOSITION VI.

When the first Term, Number of Terms, and then mon Difference are given, to find the last Term.

### R U L E.

Subtract the common Difference from the Product of Number of Terms, multiplied by the common Difference the Remainder added to the first Term will give the last

### EXAMPLES.

ginning at 6, and continuing by the increase of 19 Places?

irst 19x3=57, the Number of Terms multiplied by the the Excess.

hen 54+6=60, the last Term. Q. E. F.

What is the last Term of an Arithmetic Progression, beginning at 1, and continuing by the Increase of 2 to 100 Places?

### PROPOSITION VII.

The first Term, common Difference, and Number of

### RULE.

From the Product of the Number of Terms in the comin Difference, subtract the common Difference, and to Remainder add the Double of the first Term; half the iduct of that Sum multiplied by the Number of Terms, les the Sum of all the Series.

### EXAMPLE.

A Gentleman bargains with a Bricklayer to fink him a Well 30 Yards deep, upon these Terms, viz. to pay him three Shillings for the first Yard, sive for the second, seven for the third, &c. raising two Shillings for every Yard; what will be due to the Bricklayer for completing the same?

1  $30 \times 2 = 60$ ; also 60 - 2 = 58.

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 $\sin 58+6=64$ , and  $64\times30=1920$ 

1920-2=960 Shillings=481. Q. E. F.

### P.ROPOSITION VIII.

he first Term, the Number of Terms, and Sum of all Terms given, to find the common Difference.

### RULE.

ivide the double Sum of all the Series by the Number erms, and from the Quotient subtract double the first a; divide the Remainder by the Number of Terms lessely Unity, the Quotient will be the common Differ-

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# EXAMPLES.

18. A Gentleman travelled 200 Miles in eight Days, and every Day travelled equally farther than the preceding Day; it is known that the first Day he travelled in Miles; how many Miles did he travel each of the other Days?

First, 400-8=50, and 50—12=38, Also, 8—1=7.
Then 7)38(5\frac{3}{7}\) Miles, the common Difference required.
.: 5\frac{3}{7}\) added to 6, and every other Term respectively.

gives	113 for	the fecond	1
	165	third	
	222	fourth	
	27 5	fifth	Day's Journey.
	337	fixth	Q.E.F.
	384	feventh	
	44	eighth	J

Proof 200 Miles.

Miles, in 9 Days, and every Day travelled equally a ther than the preceding Day; it is known that the many he travelled 4 Miles; how many Miles did he travel each of the other Days?

### PROPOSITION IX.

When one Person or Thing moves with an equal, and at other the same Way by a Progressive Motion, to find the what Time the first will be overtaken.

#### RULE.

To double the Space gone each Day by the pursued, at the common Difference of the Pursuer's Day's Journey, fro that Sum subtract double the Space he travelled the first Da and divide the Remainder by the common Difference, to Quotient will give the Number of Days, in which the suffered will be overtaken by the Pursuer.

### EXAMPLE 8.

n

20. A noted Highwayman having committed a Robber not fuspecting a Pursuit, fled Northward at the Re of nine Leagues a Day; one of Sir John Fieldin Me

Men, upon the Scent, follows him in a progressive Motion, only three Leagues the first Day, five the Second, seven the third, and so on, increasing every Day's Journey two Leagues: in how many Days will the Highwayman be overtaken?

x2=18 Leagues, double the Space gone each Day by the

purfued.

2 common Difference of the Pursuer's Day's Journey

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Idio Me 6 Double the Space gone the first Day by the Pursuer 2)14 Remainder, which divided by the common Dist.

Gives 7 Days the Answer.

For 7x9=63 Leagues, the Space travelled by the Robber.
Then, by Prop. VII. 7x2=14, also 14-2=12, and 12+6=

. 18:2x7=63 Leagues, when the Thief-taker comes

up with the Highwayman.

1. Y. Z. made the follow Bet for 1000 Guineas, to be decided the Monday, Tuesday, and Wednesday in Whitfun-Week, on Barham Downs, between the Hours of Eight in the Morning, and Eight at Night. The Proposer has 10 choice Cricketers in full Exercise, who on this Occasion, are to be distinguished by the first 10 Letters of the Alphabet. These are to run and gather up, and carry fingly, 1000 Eggs, laid in a right Line, just two Yards asunder, putting them gently into a Basket placed just a Fathom behind the first. They are to work one at a Time, in the following Order: A is to fetch up the first 10 Eggs, B the second, C the third ten, and so forward to K, whose Turn it will be to fetch up the 100th Egg. After which A fets out again for the next 10, B takes the next, and so forward alternately, till K. shall have carried up the 1000th Egg, at 100 Eggs per Man. The Fellows are to have 300%. for their three Days Work, if they do it, and it is to be distributed in Proportion to the Ground each Man shall in his Course have gone over; required, first, how many Miles each Person will have run; secondly, what Part of the 300% will come to his Share; thirdly, whe ther, if the Men had been posted at proper Places they had not better have run from London to York twice, and back in the Time, taking the Measure at 180 Miles?

22. Suppose a Man to have a Calf, which at the end of three Years begins to breed (and afterwards) a semale Calf every three Years, bringing forth a Cow-Call every Year, and these last breed in the same Manner, &c. to determine the Owner's whole Stock at the End of 20 Years?

### 36. GEOMETRICAL PROGRESSION

Is when any Rank or Series of Numbers increase by on common Multiplier, or decrease by one common Divisor.

As 2.4.8.16.32.64. here the common Multiplier of Ratio is 2.

Also 729. 243.81.27.9.3. here the common Divisor

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In any Series of Numbers in Geometrical Progression, in Product of the two Extremes are equal to the Product of an two Means that are equally distant from the Extremes.

> As 3. 9. 27. 81. 243 729. Here 3×729=27×81=9×243=2187.

When the Number of Terms are odd, the middle Ten multiplied into itself will be equal to the Product of them Extremes, or any two Means equally distant from the said Mean or middle Term.

> As 3.6.12.24.48. 12+12=6×24=48×3=144.

In Geometrical Progression, the same five Things are be observed, as in Arithmetical Progression, viz.

. The first Term.

2. The last Term.

3. The Number of Terms.

4. The Ratio.

5. The Sum of the Terms.

Any three of these being known, the Rest may be found.

If to any Series of Numbers in Geometrical Proportion

when the first Term is not an Unit, or the same as Ratio, out not an Unit, and there be assigned a Series of Numbers n Arithmetical Progression, beginning with an Unit or 1, and whose common Difference is 1, called Indices or Exponents.

Thus { 1.2.3. 4. 5. 6. 7 Indices. 2.4.8.16.32.64.128. Number in Geometrical Progr.

The Addition or Subtraction of the Indices (or Numbers n Arithmetical Progression) directly correspond with the Product or Quotient of their respective Terms or Series in Geometrical Progression.

That is { As 3+6=9 So 8×64=512 the 9th Term in ::

Again { As 6+6=12 | So 64×64=4092 the 12th Term in ::

Or  $\begin{cases} As 6-3=3. \\ So 64-8=8. \end{cases}$ 

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Or  $\begin{cases} As 7-2=5. \\ So 128 \div 4=32, &c. \end{cases}$ 

But if the Series begin with Unity, or 1, the Indices must

Thus {0, 1, 2, 3, 4, 5, 6, 7, &c. Indices.

Now by these Indices, and a few-of the first Terms, the st Term, or any distant one, may be speedily found, withut producing the whole Series.

### PROPOSITION I.

When the first Term is Unity, the Ratio and Number of erms being known, to find the last of any remote Term.

### R. U L E.

Find a few of the leading Terms over which place their Inces, as before directed, then find what Figures of the Inces, which added together will give the Index of the erm wanted, multiply the Numbers standing under such dices into each other, and the last Product will be the erm required.

Note, When the Indices begin with a Cypher, the Sum of the Indices made choice of must be always one less than

than the Number of Terms given in Question, as in the Indices stands over the second Term.

# EXAMPLES.

1. A Boy agrees for 16 Oranges, to pay only the Price of the last, reckoning a Farthing for the first, an Halfpenn for the second, &c. doubling the Price to the last. How much did he give for them?

First { 0, 1, 2, 3, 4, 5, Indices, 1, 2, 4, 8, 16, 32, Terms.

Then  $\begin{cases} 5+5=10 \\ 32\times32=1024 \end{cases}$  Also  $\begin{cases} 10+5=15 \\ 1024\times32=32768, \text{ qrs.} \end{cases}$  which is the 16th Term, as the Indices are less than the Terms by one.

And 32768 Farthings=341. 21. 8d. Q. E. F.

2. A Man bought a Horse, and by Agreement was to give what the last Nail would come to, at a Farthing for his first Nail; two for the second, four for the third, to there were 4 Shoes, and 9 Nails in each Shoe: I do mand the Price of the Horse?

### PROPOSITION IL.

In any Series, not proceeding from Unity, the Ration first Term being given, to find any remote Term, without producing all the intermediate Terms.

# R U L E.

Proceed as in the last Proposition, only observe to divine every Product by the first Term, and the Quotient will the Term required.

### EXAMPLES.

3. A Person dying left 11 Children, to whom and to his E ecutor he bequeathed in the Manner following, viz. his Executor, for seeing his Will personned, 10/1 youngest Child to have 30/1 and so on every Child exceed the next younger in triple Proportion: Will be the Share of the eldest?

First {0, 1, 2, 3, 4, 5, 6, Indices. 0. 30, 90, 270, 810, 2430, 7290, Terms.

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Then \\ \frac{5+6=11}{2430\times 7290=17714700} \text{ which \times 10. the first Term \\ = 17714701. Eldest Child's Fortune.

A Nobleman dving left ten Sons, to whom he left a certain Sum of Money to be divided among them, viz. the youngest Son to have gool, the second to have as much and half as much, and so on every one to exceed the next younger in the same Ratio of 1½. What is the Share of the eldest?

### PROPOSITION III.

When the first Term, Ratio, and Number of Terms are ven, to find the Sum of all the Terms.

### RULE.

Find the last Term as before, from which take the first, vide the Remainder by the Ratio, less one, and to that untient add the last Term, gives the Sum required.

### EXAMPLES.

On New-Year's Day a Gentleman married, and received of his Father-in-law a Guines, on Condition that he was to have a Prefent on the first Day of every Month for the first Year, which should be double still to what he had the Month before; what was the young Lady's Portion?

First  $\begin{cases} 0.1.2.3.4.5.6. \text{ Indices.} \\ 1.2.4.8.16.32.64. \text{ Terms.} \end{cases}$ Then  $\begin{cases} 6+5=11 \text{ No. of Terms less one.} \\ 64\times32=2048 \text{ last Term.} \end{cases}$ And 2048-1-2-1=2047Also 2047+2048=4095 Guineas. 20)4095 204 15

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One, at a Country Fair, had a mind to a String of 20 fine Horses; but not caring to take them at 20 Guineas per Head, the Jockey consented, that he should, if he thought good, pay but a single Farthing for the first, doubling it only to the 19th, and he would give the 20th

into the Bargain: this being presently accepted, in

were they fold per Head?

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7. A Laceman well versed in Numbers, agreed with a Gentleman to sell him 20 Yards of rich Gold brocaded land for 2 Pins the first Yard, 6 for the second, 18 for the third, and so on in triple Proportion, I demand he much the Lace produced, the Pins afterwards sold at Farthing per 100; also whether the Laceman gained lost by the Sale thereof, supposing the said Lace to he been bought at 81. 15. 8d. per Yard?

Numbers) to serve him 11 Years without any others ward for his Service, but the Produce of a Wheat-Co for the first Year, and that Product to be sown the sen Year, and so on from Year to Year until the End of Time, allowing the Increase to be but ten fold Proportion; I demand what the 11 Years Service came supposing the Sum of the whole Produce to be sold 4s. per Bushel?

Note, 7680 Wheat Corns, round and dry out of the Mid of the Ear, are computed to fill a Statute Pint.

# PROPOSITION IV.

Of any decreasing Series in ..., whose last Term is a

### . R. U. L. E.

Divide the Square of the first Term by the Difference tween the said first Term and the second Term in the San the Quotient will be the Sum of the Series.

### EXAMPLES.

at the Distance of four Leagues from it, and sails in as fast as the small Ship. Tis asked how far the?

Ship must fail before it overtakes the lesser?

First 4, 2, 1, \(\frac{1}{2}\), \(\frac{1}{4}\), \(\frac{1}{8}\), &c. ad infinitum.

Then 4×4=16, Square of the first Term.

And 16-2 the second Term=8 Leagues, the Answer

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Suppose a Ball to be put in Motion by a Force which drives it 12 Miles the first Hour, 10 the second, and so on continually decreasing in Proportion of 12 to 10 to Infinity; What Space would it move through?

## 37. PERMUTATION,

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## VARIATIONS.

the changing or varying the Order of Things, in re-

#### RULE.

sustiply all the given Terms in a Series of Arithmetical gressionals continually, whose first Term or common brence is Unity or 1, and the last Term of the Number Things proposed to be varied together, and the last lust will be the Number of Changes or Variations reed.

## EXAMPLES.

ix Gentlemen that were travelling, met together by Chance at a certain Inn upon the Road, where they were so pleased with their Landlord, and each other's Company, that in a Frolick they made a Contract to say at that Place, so long as they, together with their Landlord, could sit every Day in a different Order or Position at Dinner: Quere, the Time they stayed? demand the Number of Changes that may be rung on 12 Bells; also, in what Time may they all be rung, allowing 3 Seconds to every round, and 365 Days, 6

Hours, to the Year.

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n Accomptant told a Gentleman, who had constantly 8 Persons at his Table, that he would gladly make a ninth, and was willing to give 20 Guineas for his Board, so long as he could place the said Company at Dinner, differently from any one Day before; this being accepted, what did his Entertainment cost him per Year?

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## VULGAR FRACTIONS

A FRACTION is a Part or Parts of fomething of dered as an Unit or Integer, and confifts in two or Quantities, one wrote over the other with a Line bear

them, as 1, 3, 15, &c.

The Number placed below the Line is called the D minator of the Fraction, because it denominates or how many Parts the Unit is broken or divided into the Number above the Line is called the Numerator, cause it enumerates or shews how many of those Parts contained in the Fraction.

A Vulgar Fraction is either proper, improper, comp

or mixed.

A proper Fraction is when the Numerator is less the Denominator, as  $\frac{2}{3}$ ,  $\frac{2}{3}$ ,  $\frac{165}{213}$ , &c.

An improper Fraction is such whose Numerator is to, or greater than its Denominator, as  $\frac{4}{2}$ ,  $\frac{18}{12}$ ,  $\frac{247}{447}$ . A compound Fraction is the Fraction of a Fraction

known by the Word of, as 3 of 7 of 4, &c.

A mixed Number is composed of an whole Number Fraction, as 41, 127, 14210, &c.

# REDUCTION of VULGAR FRACTION CASE 1.

To reduce a Vulgar Fraction to its lowest Terms

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## R. U.L.E.

Divide the greater Term by the lesser, and that Divisor the Remainder following, till nothing remains; then by last Remainder divide both Parts of the Fraction, and Quotients will give the Fraction required: if the Render is 1, the Fraction is already in its least Terms.

## EXAMPLES.

First 336)896(2 then 112)336(3 the Answer.

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educe  $\frac{2}{12}\frac{3}{8}\frac{1}{4}\frac{2}{8}$  to its lowest Terms.

educe  $\frac{1}{5}\frac{4}{6}\frac{4}{6}$  to its lowest Terms.

educe  $\frac{1}{3}\frac{9}{3}\frac{2}{6}$  to its lowest Terms.

educe  $\frac{1}{1}\frac{4}{9}\frac{7}{3}\frac{6}{8}$  to its lowest Terms.

hen the Numerator and Denominator do each of them with Cyphers, strike off an equal Number of Cyphers th, and the remaining Figures will be a Fraction of time Value, which reduce to its lowest Terms.

## EXAMPLES.

educe 10000 to its lowest Terms.

Thus 19/000=19 the Answer.

educe 4200 to its lowest Terms.

hen you differn any Number will equally divide both trator and Denominator you may abbreviate the Frachereby.

duce 124, 364, 60, and 120 to their lowest Terms.

## CASE II.

o reduce a compound Fraction to assingle One.

## RULE.

tiply all the Numerators together for a new Numeand all Denominators for a new Denominator. Rehe new Fraction to its lowest Terms by the last Case.

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## EXAMPLES.

8. Reduce 1 of 6 of 11 to a fingle Fraction. First 3×6×11=198 new Numerator. And 4×8×12=384 new Denominator Then 198 is the fingle Fraction, which reduced to lowest Terms=33.

9. Reduce 2 of 4 to a fingle Fraction.

to. Reduce of of of of to a fingle Fraction.

tr. Reduce & of a of a to a fingle Fraction,

12. Reduce 3 of 3 of 3 to a fingle Fraction.

#### CASE III.

To reduce whole or mixed Numbers into an impr Fraction:

1. If the whole Number has no affigned Denominator Unity subscribed underneath must be the Denomin

z. If the whole Number has an affigued Denominator, tiply the whole Number by the affigned Denomin and the Product will be the Numerator to the an

Denominator.

3. If the whole Number has a Fraction annexed, me the whole Number by the Denominator of the Fr and to the Product add the Numerator for 2 new merator, which place over the Denominator.

## EXAMPLES.

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13. Reduce 7, 14, and 124 to Fractions. Thus 7=7, 14=14, 124=124, &c.

14. Reduce 15 into a Fraction whose Denominator be 9.

Thus 15×9=135 Numerator, .. 135 the Fraction 109 15. Reduce 475 to an improper Fraction.

Thus 47×7+6=335 new Numerator; under which p the Denominator, gives 335 the Fraction require

16. Reduce 12; 27, and 176 to Fractions.

17. Reduce 27 into a Fraction whose Denominator be 12.

Reduce  $4\frac{2}{7}$  to an improper Fraction. Reduce  $16\frac{1}{2}$  to an improper Fraction. Reduce  $142\frac{17}{23}$  to an improper Fraction. Reduce  $146\frac{1}{37}$  to an improper Fraction.

## C A S E IV.

To reduce an improper Fraction into its equivalent or per Terms.

## RULE.

Divide the Numerator by the Denominator, the Quotient es the whole Number, and under the Remainder (if any) scribe the Denominator.

### EXAMPLES.

Reduce 30 to its proper Terms.

Thus 30: 247 the Terms required.

Reduce 3 3 to its proper Terms.

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Reduce 3237 to its proper Terms.

Reduce 5423 to its proper Terms.

#### CASEV

oreduce Fractions of different Denominations to Fracs of equal Value, that shall have one common Denomitr.

## RULE.

lultiply each Numerator (taken separately) into all the ominators but its own, and the Products will be the new nerators: then multiply all the Denominators into one her for a common Denominator.

## EXAMPLES.

Reduce 2, 3, and 4 to a common Denominator.

First  $\begin{cases} 2 \times 4 \times 5 = 40 \text{ the first} \\ 3 \times 3 \times 5 = 45 \text{ second} \\ 4 \times 4 \times 3 = 48 \text{ third} \end{cases}$  New Numerator.

And  $3\times4\times5=60$  the common Denominator.

6,45 and  $48 \text{ are all of the fame Value with the respective original ones, and have one common Denominator.

Q.E.D.$ 

Reduce \frac{1}{3}, \frac{7}{8}, \frac{5}{9}, \frac{1}{12} to a common Denominator.

- 27. Reduce 3, 11, and 75 to a common Denominator.
- 28. Reduce \(\frac{1}{3}, \frac{1}{4}, \frac{1}{5}\), and \(\frac{1}{6}\) of \(\frac{7}{8}\) to a common Denomination
- 29. Reduce 1, 1, 1, 1, and to a common Denominator.
- 30. Reduce 5, 70, 3, and 3 of 3, to a common Denomina

## C A S E VI.

To reduce Fractions of one Denomination to another, taining the fame Value.

## RULE.

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- 1. If the Fraction given is to be brought from a less greater Denomination; multiply the Denominator the farts contained in the several Denominations tween it, and that you would reduce it to, for a Denominator, which placed under the given Numera will give the new Fraction, which reduce to its lo Terms.
- 2. If the Fraction given is to be brought from a greater less Denomination, then multiply the Numeratorin fame Manner as you did before the Denominator, place over the given Denominator, and it will give new Fraction, which also reduce to its lowest Terms

## EXAMPLES.

31. Reduce 3 of a Penny to the Fraction of a f.

Thus  $\frac{3}{8 \times 12 \times 20} = \frac{3}{1920}$  or  $\frac{1}{640}$  the Fraction required.

32. Reduce 1728 of a Moidore to the Fraction of a Farth

Thus  $\frac{1\times27\times12\times4}{\Gamma_{7}28} = \frac{1296}{\Gamma_{7}28}$  or  $\frac{3}{4}$  the Fraction required.

- 33. Reduce & of a Shilling to the Fraction of a Guinea.
- 34. Reduce 120 of a f. to the Fraction of a Penny.
- 35. Reduce & of a Farthing to the Fraction of a Moidore
- 36. Reduce of a Penny to the Fraction of a f.
- 37. Reduce T3 14 of a Guinea to the Fraction of a Farth
- 38. Reduce of of a dwt. to the Fraction of a b. Troy.
- 39. Reduce 43 of a cwt. to the Fraction of a lb. Avoir
- 40 Reduce a of a Dram to the fraction of a ewt.
- 41. Reduce 144 of a lb. Troy to the Fraction of a dwt.
- 42. Reduce 3 of a League to the Fraction of a Pole.

Reduce  $\frac{7}{45}$  of a Yard to the Fraction of a Nail. Reduce  $\frac{7}{12}$  of a Gallon of Wine to the Fraction of a hhd.

Reduce  $\frac{7}{9}$  of a hhd. of Ale to the Fraction of a Pint. Reduce  $\frac{7}{142}$  of a Chaldron to the Fraction of a Bushel. Reduce  $\frac{3}{5}$  of a Gallon to the Fraction of a Chaldron. Reduce  $\frac{7}{142}$  of a Week to the Fraction of a Second. Reduce  $\frac{1}{11}$  of a Minute to the Fraction of a Day.

#### CASE VII.

To find the proper Quantity or Value of a Fraction in ney, Weights, or Measures.

#### RULE.

sultiply the Numerator of the given Fraction by the scontained in the Integer to which it belongs, then dithat Product by the Denominator, and if any Thing reas, reduce it to the next Denomination less, and divide in by the Denominator; thus proceed to the least Denominator.

#### EXAMPLES.

Reduce 161 of a f. to its proper Quantity.

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48)96(2 grs.

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51. Reduce 367 of a Moidore to its proper Quantity.

52. Reduce 5 of a Guinea to its proper Quantity. 53. Reduce & of a Shilling to its proper Quantity.

54. Reduce 4 of a Three-Pound-Twelve to its proper Qu tity.

55. What is the Value of 5 of a f.

56, Reduce 411 of alb. Troy to its proper Quantity.

57. What is the Value of 7 of a cwt.

58. Reduce 63 of a Ton to its proper Quantity.

19. What is the Value of 3 of a Mile?

60. Reduce & of an Ell English to its proper Quantity.

61. Reduce ? of an Acre to its proper Quantity. 62. What is the Value of 11/252 of a hhd. of Wine?

63. Reduce 3 of a Barrel of Beer to its proper Quantity
64. Reduce 23 of a Chaldron of Coals to its proper Quant

65. What is the Value of ? of a Month?

66. Reduce 3 of a Day to its proper Quantity.

## C A S E VIII.

To reduce Money, Weights, or Measures into Fraction

## RULE.

Reduce the given Quantity to the lowest Name mention for a Numerator; under which put the Number of Parts contained in an Unit of the Integer for a Denomin then reduce the Fraction to its lowest Terms.

## EXAMPLES.

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67. Reduce 61. 82d. to the Fraction of a C. First 6s. 81d.=161 Half Pence. And 1 / = 480 ditto. Then 160 is the Fraction required.

68. Reduce 41d. to the Fraction of a Shilling.

69. Reduce 21. 171. 75d. to the Fraction of a Three-P Twelve.

70. Reduce 8s. 2d. to the Fraction of a Guinea.

71. Reduce 6 oz. 17 dw. 21 gr. to the Fraction of alb. 72. Reduce 3 qrs. 3 lb. 1 02. 125 drs. to the Fraction

ewt.

Reduce 10 cwt. 18 lb. 1 oz. \(\frac{1}{31}\) to the Fraction of a Ton.
Reduce 3 qrs. \(\frac{1}{8}\) to the Fraction of an Ell English.

Reduce 2 f. 6 in. to the Fraction of a Yard.

Reduce 4 fur. 3z p. to the Fraction of a Mile.

Reduce 3 r. 2 p. to the Fraction of an Acre.

Reduce 42 gal. of Wine to the Fraction of a hhd.

p. Reduce 28 gal. of Beer to the Fraction of a Barrel.

D. Reduce 14 bu. 2 p. to the Fraction of a Chaldron.

. Reduce 1 w. 3 d. 12 h. to the Fraction of a Month.

Reduce 243 d. 8 h. to the Fraction of a Year (allowing 365 Days to the Year.)

## 39. ADDITION of VULGAR FRACTIONS.

## RULE.

Reduce the given Fractions to a common Denominator,

by Case V. in Reduction.

Add all the Numerators together for a new Numerator, under which subscribe the common Denominator. And if it is an improper Fraction, reduce it to its proper Terms (by Case IV.) and you have the Sum of all the Fractions.

## EXAMPLES.

Add  $\frac{1}{3}$ ,  $\frac{4}{7}$ , and  $\frac{5}{8}$  together. Thus (per Case V.)  $\frac{1}{8} + \frac{4}{7} + \frac{5}{8} = \frac{16}{168} + \frac{96}{168} + \frac{105}{168} = \frac{257}{168}$ . Then (per Case IV.)  $\frac{257}{168} = 1 \cdot \frac{39}{168}$  the Sum required.

Add 3, 1, and 5 together.

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Add  $\frac{1}{2}$ ,  $\frac{2}{3}$ ,  $\frac{3}{4}$ ,  $\frac{4}{5}$ , and  $\frac{5}{6}$  together.

Add \(\frac{2}{3}\), of \(\frac{4}{5}\), and \(\frac{13}{15}\) together.

Add \(\frac{3}{7}\) of \(\frac{5}{5}\) to \(\frac{5}{9}\) of \(\frac{3}{4}\).

Add  $\frac{1}{2}$ ,  $\frac{1}{3}$ ,  $\frac{1}{4}$ , and  $\frac{1}{3}$  of  $\frac{1}{6}$  into one Sum.

To add mixed Numbers.

### RULE.

Reduce the Fractions to a common Denominator, and add m together, as before directed, and annex their Sum to Sum of the Integers.

Q3

EXAMPLES.

## EXAMPLES.

7: Add 41 and 171 together.

First \(\frac{1}{2} + \frac{3}{4} = \frac{4}{8} + \frac{6}{8}\) or \(\frac{2}{4} + \frac{3}{4} = \frac{5}{4}\) or \(\frac{1}{4}\).

Then \(4 + 17 + 1\frac{1}{4} = 22\frac{1}{8}\) their Sum.

8. Add 73, 94, and 670 together.

9. Add 81, 92, 103, 114, and 125 into one Sum.

When the given Fractions are of several Denominations

#### RULE.

Reduce them to one Denomination (by Case VIII) the add them together as before directed; or you may reduce them to their proper Quantities (by Case III) and add in Sect. WHE 1X

10. Add 3 of a f. to 3 of a Shilling.

First  $\frac{2}{3}$  of  $\frac{2}{1} = \frac{40}{3}$ , then  $\frac{40}{3} + \frac{2}{9} = \frac{360}{27} + \frac{6}{27} = \frac{366}{27}$  or 13

11. Add 201 of a f. to 8 of a Shilling.

12. Add tof a lby Troy to 3 of an oz.

13. Add s of an cwt, to 1 of a lb.

14. Add 3 of a Yard to 3 of an Ell Eng.

15. To \$ of a Mile add 3 of a Yard.

16. Add 3 of a Children to 1 of a Peck.
17. To 1 of a Week add 5 of a Month.

18. Add 4 of an Hour to 8 of a Week.

19. Add \(\frac{2}{5}\) of 121. +4\(\frac{3}{7}\) +\(\frac{1}{5}\) of \(\frac{2}{18}\) of a 1. +\(\frac{3}{5}\) of \(\frac{2}{5}\) of a Shi ling into one Sum.

## 40. SUBTRACTION of VULGAR FRACTIONS

## RULE.

1. Prepare the Fractions as before directed in Addition

2. Subtract one Numerator, from the other, and their Difference will be a new Numerator, under which is scribe the common Denominator.

## EXAMPLES.

From 7 take 1. First 7 and 1 (per Case V.) will become 7 and 1. then 7 - 8 = 1 the Difference required.

2. It is required to subtract 2 from 17.

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5. From 32 take 23. I wish an army pit sight in From  $\frac{14}{4}$  take  $\frac{7}{4}$ .

From  $\frac{3}{4}$  of  $\frac{7}{8}$  take  $\frac{2}{3}$  of  $\frac{7}{4}$ . From 103 take 65 From 17 12 take 166. From 12 take 5 of 7 of 1. From 2 of a Shilling take 3 of a Penny. From  $\frac{1}{3}$  of a cwt. take  $\frac{3}{4}$  of an oz. From 3 of a Yard, take 3 of an Inch. From 3 of a Chaldron take 3 of a Peck. . From 5 of a Day take 3 of an Hour.

## MULTIPLICATION of VULGAR FRACTIONS.

#### RULE.

Prepare the Fractions to be multiplied, i. e. reduce compound Fractions to simple ones, per Case II. bring mixed Numbers into improper Fractions, per Case III. and express whole Numbers Fraction-wise, by subscribing an Unit for a Denominator; then reduce the Fractions into their lowest Terms.

Multiply the Numerators into one another for a New Numerator; and the Denominators into one another for a New Denominator.

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3. Fr

Mul. 123 by 7 of 12.

Thus  $\frac{4\times3}{7\times5} = \frac{12}{35}$  the Product required. Multiply 4 by 3.

Mul.  $\frac{6}{11}$  by  $\frac{7}{12}$ . 7. Mul. 3 of 10 by x 6 Mul. 12 1/2 by 6.

8. Mul. 3 of 3 by 2 of 5 of 14. Multiply 173 by 78. Mul. 23 by 3 of 7.

9. Mul. 3<sup>2</sup>/<sub>3</sub> by ½, and this Product again by ½ of ¾.

## 42. DIVISION of VULGAR FRACTIONS.

## RULE.

repare the Fractions as (before directed) in Multiplication.

2. Multiply

2. Multiply the Numerator of the Dividend into the Denominator of the dividing Fraction, for a New Numerator, and multiply the other Numerator and Denominator together for a New Denominator, or invert the Divisor, and then proceed as in Sect. 41.

## EXAMPLES.

1. Divide  $\frac{3}{4}$  by  $\frac{2}{9}$ . Thus  $\begin{cases} 3 \times 9 = \frac{27}{8} = 3\frac{3}{8} \end{cases}$  the Quotient, Or thus,  $\frac{3}{4} \times \frac{9}{2} = \frac{27}{8}$  as before.

2. Divide  $\frac{6}{7}$  by  $\frac{3}{5}$ .

3. Divide  $\frac{2}{11}$  by  $\frac{2}{3}$  of  $\frac{7}{8}$ .

4. Divide  $12\frac{1}{2}$  by  $17\frac{2}{3}$ .

5. Divide  $12\frac{3}{4}$  by  $3\frac{7}{8}$ .

6. Divide  $\frac{7}{8}$  of  $\frac{3}{4}$  by  $\frac{2}{5}$  of 12.

10. Divide  $142\frac{7}{12}$  by  $12\frac{3}{5}$ .

11. Divide  $\frac{7}{8}$  of 6 by  $\frac{3}{4}$  of  $\frac{11}{12}$ .

# 43. The RULE of THREE DIRECT IN VULGAR FRACTIONS.

There are two Methods to perform this Rule, the second which is the most expeditious and easiest.

## RULEI

Prepare the Fractions if required as in directed Mulup cation, then proceed as in Sect. 12. Or,

## RULE II.

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Having reduced the Fraction and stated the Question, before directed.

Multiply the Denominator of your first Number into Numerators of the second and third for a new Numerator then multiply the Numerator of the first Number into Denominator of the second and third, for a New Denomator, and place it under the New Numerator, for an swer, which reduce to its proper Quantity.

## EXAMPLES.

1. If \(\frac{3}{4}\) of a Yard of Cloth cost \(\frac{4}{5}\) of a \(\frac{1}{6}\). what will Yard come to at the same Rate?

First  $24\frac{3}{8} = \frac{19}{8}$ , then if  $\frac{3}{2}$  yd. :  $\frac{4}{5}$  l. : : 19  $\frac{5}{8}$  yds.

Now per Rule 1,  $\frac{4}{5} \times \frac{19}{5} = \frac{78}{4} = \frac{9}{9}$  or  $\frac{39}{2}$ , And  $\frac{39}{2} \div \frac{3}{4} = \frac{26}{12}$ . the Answer.

Or thus, per Rule 2, 4×4×195=3120 N. And 37 = 120 D.

Then  $3\frac{12}{12}|_{0}^{\circ}=26l$ . the Answer as before.

If 23 Yards of Silk cost 34%, what will 44 Yards cost at the same Rate?

If \( \frac{3}{4}\) of a lb. cost 5s. 6d. what will 42\( \frac{3}{8}\) lb. of the same cost?

Suppose I give 14s. 8d. for 7 cwt. what must be given for 8 cwt. of the same, at that Rate?

A Merchant makes an Assurance upon a Ship and Cargo, bound to a certain Port, Value 27001. 101. and agrees to pay 10 Guineas per Cent, what comes the Premium or Charges of the Assurance?

How much South Sea Stock, at 1125 l. per Cent. will 1270l. Purchase?

A Mercer bought 42 Pieces of Silk, each Piece containing 223 Yards, and was to give 8s. 9d. per Yard; I demand the Value of the Whole?

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If I give 1001. 101. 6d. for 12 Pieces of Holland, at the Rate of 51. 64d. per Ell Flemish; I demand how many. Ells English each Piece contained?

## The RULE of THREE INVERSE.

## In VULOAR FRACTIONS:

As I observed in the Rule of Three Direct, of there being of Methods of performing it, so likewise in this.

## RULE I.

Prepare the Fraction as before directed, and then proceed in Sect. 13, or,

## RULEII

Multiply the Denominator of the third Number into the unerator of the first and second for a new Numerator; en multiply the Numerator of the third Number into the enominator of the first and second, for a Denominator, lich place under the Numerator for an Answer, and find a proper Quantity as before.

## EXAMPLES.

How many Yards of Cloth, & wide, are equal to 422

Fir

First  $42\frac{1}{2} = \frac{85}{2}$ , then if  $\frac{5}{4}$  Yards, :  $\frac{35}{4}$  Yards, : :  $\frac{3}{4}$  Yard. Now by Rule 1.  $\frac{35}{2} \times \frac{5}{4} = \frac{425}{5}$ , And  $\frac{425}{5} = \frac{3}{4} = \frac{1700}{24}$ , or 70  $\frac{5}{6}$  Yards the Answer.

Or thus, but the Rule 2,  $\begin{cases} 5 \times 85 \times 4 = \frac{1700}{24} \text{ or } 70\frac{5}{6} \text{ Yards the} \\ 4 \times 2 \times 4 = 24 \end{cases}$ 

Answer, as before.

2. A lends B 25 1/3 for 61 Months; how long ought B tolet
A have 101/4. to requite his kindness?

3. If 4 Men can do a Piece of Work in 123 Hours, in how

many Hours will 12 Men do the same?

4. If the Penny Loaf weighs 123 oz. when the Bushel of Wheat is fold for 55. what is the Bushel worth, when the Penny Loaf weighs 83 oz.

5. Suppose A lends to B 1003/2. for 63 Months, what Sum must B lend A for 35 Years to requite him?

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6. How many Yards of Cloth at 8s. 6d. per Yard, mult be given for 26 grands, at 5s. 7d. per Yard?

# In VULGAR FRACTIONS.

## RULE.

Prepare the Number as before directed, and then proces as in (15)

## EXAMPLES.

y Months, at 61. per Cent. per Annum?

First, 41. 155. =  $4\frac{3}{4}$ =  $\frac{191}{4}$ . And 9 mo. =  $\frac{3}{4}$ .

and one of the Then too : 4 : 4 the second of which the

Then 100: 1 : 4 the said and th

Now per Sect. 15. Rule 5.  $\frac{6}{1} \times \frac{3}{4} = \frac{18}{4} = \frac{9}{2}$  the Divider.

And  $\frac{199}{4} \times \frac{1}{1} \times \frac{19}{4} = \frac{1999}{4} = \frac{475}{1}$  the Dividend.

Then 475-9-950=1051. 111. 14d. 1 the Answer.

2. Suppose 12 Students spend 141. 61. 8d. in 16 Days, he much will 18 Students spend in 34 Days?

3. If the Carriage of 40 cwt. 30 Miles cost 161. 131. 4 what Weight may I have carried 80 Miles for 61. 1 6d. at the same Rate?

Six Men; with their Wives, upon Calculation, found that their Expences for three Months past amounted to 261. 195. 4d. I demand what Time 141. 155. may be spent by 36 Men in the like Proportion?

If 30 Men can perform a Piece of Work in eleven Days, how many will accomplish another, four Times as big,

in one fifth of the Time?

Agreed for the Carriage of  $2\frac{1}{2}$  Tons of Goods, 3 Miles wanting  $\frac{1}{10}$ , for  $\frac{1}{5}$  of  $\frac{3}{5}$  of a Guinea: What was that per cwt. for a Mile?

## QUESTIONS for EXERCISE in FRACTIONS.

Four Figures of nine may be so placed and disposed of as to denote and read for 100, neither more or less:

Pray how is that to be done?

What Number is that, to which if 3 of 18 of 141 be

added, the Total will be 1?

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What Number is that, from which, if you deduct the  $\frac{1}{25}$  of  $\frac{7}{8}$ , and to the Remainder add  $\frac{1}{16}$  of  $\frac{47}{19}$ , the Sum will be 3?

What Number is that, to which if you add I of 12 more I of 27, and from the Total subtract i of 71,

less 29 of 11, the Remainder shall be 8?

There is a Number, which, if multiplied by \(\frac{2}{3}\) of \(\frac{2}{3}\), will produce no more than 1: What is the Cube of that Number?

There is a Number, which, if divided by 16/3 of 16/3 will quote 92/37: Pray what is the Square of that Number?

13/7 of 4/5 of 3/8 of a Ship be worth 1/9 of 5/7 of 11/3 of the Cargo, Value at 12000/. what did both Ship and Car-

go fland the Owners in?

Person was possessed of a 3 Share of a Copper Mine, and sold 3 of his Interest therein for 1710l. what was the reputed Value of the whole Property at the same Rate?

Father devised  $\frac{34}{83}$  of his Estate to one of his Sons, and  $\frac{34}{83}$  of the Residue to another, and the Surplus to his Relict, for her Life; the Children's Legacies

were

were found to be 2571. 31. 4d. different: pray will Money did he leave the Widow the Use of?

ro. A Person making his Will, gave to one Child \( \frac{10}{30} \) of Estate, to another \( \frac{1}{39} \), and when these Legacies at to be paid, one turned out 540l. 10s. more than other: What did the Testator die worth.

met by Mad Tom, who took from him \( \frac{5}{8} \) of \( \frac{1}{3} \) of whole Stock. Raving Ned lights on him afterwar and forced \( \frac{2}{3} \) of the Remainder from him; I luckily Positive Jack found him, and required \( \frac{1}{2} \) of what he had left. Smiling Dolly was by prom to have \( \frac{3}{4} \) of a Quarter of what Nuts he brought how how many then had the Boy left?

of his elder Brother's Fortune; and 3 and ½ Times
Elder's Money was ½ as much again as the Father

worth; what was that?

worth 34!. per hhd. the Worth of which came up but  $\frac{4}{7}$  of the Indigo they cast overboard; besides we they threw out 13 Iron Guns, worth 18!. 10s. a-pic the Value of all amounted to  $\frac{3}{7}$  of  $\frac{9}{13}$  of that and Ship and Loading: Pray what of the Value came the Port?

14. If A. having 3 of \(\frac{3}{5}\) of the Half of a Trading Sloop Cargo, worth 16131/. \(\frac{7}{10}\) fells his Brother B\(\frac{3}{5}\) of his Interest therein at prime Cost; what did it cost Brother, and what did his Cousin P pay at the

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Time for of the Remainder?

Cafe in 12 Days; Z is Man enough to do it alor 24 Days, and X in 34: In what Time then cou

get it done himself?

16. A Father dying left his Son a Fortune, 3 of which ran through in fix Months; 2 of the Remainder him a Twelve-month longer, at which Time he bare 3481. left: Pray what did his Father bequiting?

17. Kitty told her Brother George, that though her tune on her Marriage took 193121. out of the Pa

it was but 3 of 2 Years Rent, Heaven be praised for

this Yearly Income! pray what was it?

A merry young Fellow in a short Time got the better of  $\frac{1}{3}$  of his Fortune; by Advice of his Friends he then gave 22001. for an Exempt's Place in the Guards; his Profusion continued till he had no more than 880 Guineas lest, which he sound by Computation was just  $\frac{3}{20}$  Part of his Money, after the Commission was bought:

Pray what was his Fortune at first?

A Person dying, left his Wise with Child, and making his Will, ordered, that if she went with a Son,  $\frac{2}{3}$  of the Estate should belong to him, and the Remainder to his Mother; and if she went with a Daughter, he appointed the Mother  $\frac{2}{3}$ , and the Girl  $\frac{1}{3}$ : But it happened that she was delivered both of a Son and Daughter; by which she lost in Equity 2000s. more than if it had been only a Girl: What would have been her Dowry had she only had a Son?

A Cistern holds 103 Gallons, and being Brim full, has two Cocks to run off the Water; by the first of which, a three Gallon Pail will be filled in 60 Seconds, by the other in 75; in what Time will this Cistern be emptied through both these Apertures together, supposing the Esslux of the Water all the

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A Politician having about him a certain Number of Crowns, faid, if  $\frac{1}{4} + \frac{1}{3} + \frac{1}{5}$  of what he had, were added together, they would make just Wilkes's Number (45);

how many Crowns had he about him?

A Gentleman has an Orchard of Fruit Trees, one half of the Trees bearing Apples, one fourth Pears, one-fixth Plumbs, and one-twelfth of them bearing Chernies: How many Fruit Trees in all grow in the faid Orchard?

A School-Master being asked how many Scholars he had, answered, If I had as many, and \(\frac{1}{2}\) as many, and \(\frac{1}{4}\) as many, I should have 99. How many had he? In the Year I wrote this, if to my Age you add

The Number 74 will then be had.

Ingenious Youths, my Age explore:

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zc. A, in a Scuffle, seized on 2 of a Parcel of Sugar Plumbs, B catched 3 of it out of his Hands, and laid hold on 3 more; D ran off with all Ala left, except =, which E afterwards fecured flily for himself; then A and C jointly set upon B, who, the Conflict, shed 1 he had, which were equally picket up by D and E, who lay perdue. B then kicked down C's Hat, and to work they all went anew for what contained; of which A got 1, B 1, D 2, and C and equal Shares of what was left of that Stock; D the ftruck of what A and B last acquired out of their Hand they with Difficulty recovered & of it in equal Shares gain, but the other three carried off a piece of the fam Upon this they called a Truce, and agreed, that the ! the Whole be left by A at first, should be equally divide among them: How much of the Prize after this D Aribotion, remained with each of the Competitors?

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## UTOR'S GUIDE.

#### PART III.

## DECIMAL FRACTIONS.

Decimal Fraction is a Fraction whose Denominator is always Unity or 1. with one or more Cyphers: thus, Unit may be imagined to be equally divided into 10 ts, and each of these into 10 more; so that by a continual cimal Sub-division, the Unit may be supposed to be divided 10, 100, 1000, and so on without End, all being equal ts, called tenth, hundredth, thousandth Parts of an Unit

n Decimal Fractions, the Figures of the Numerator are yexpressed, the Denominator being omitted, because it is ays known to consist of an Unit with so many Cyphers as te are Places in the Numerator.

Decimal Fraction is distinguished from an Integer with pint or Comma prefixed, thus, 5 which stands for \(\frac{1}{10}\), 75 \(\frac{1}{10000}\); ,2752 for \(\frac{2752}{10000}\); and 12,005 for 12,\(\frac{1}{10000}\), &c. yphers at the Right Hand of a Decimal Fraction alter its Value; for; 5 or, 50 or, 5000 is each of them of the Value, and are equal to \(\frac{1}{10}\) or \(\frac{1}{2}\); but Cyphers at the Hand, in a Decimal Fraction, decrease the Value in a old Proportion, for, 05 is \(\frac{1}{100}\) also, 0005 is \(\frac{1}{10000}\), &c. such that is a plainly appear by the following

### T A B L E.

Parts of a Million.
Parts of one C. Thousand.
Parts of one Thousand.
Parts of one Hundred.
Parts of Ten.
Units.
Thousands.
Thousands.
Thousands.
Millions.

By the above Table it also plainly appears, that as who Numbers increase towards the Lest Hand by a tensold in portion, so Decimal Parts decrease towards the Right Haby the same Proportion.

A finite Decimal is that which ends at a certain Numb of Places; but an infinite is that which no where ends.

A circulating or recurring Decimal is that wherein one more Figures are continually repeated.

Thus 64,766666, &c. is called a fingle circulate or re

ring Decimal.

And 147,642642, &c. is called a compound recurring cimal.

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Note, In all Operations, if the Result consists of ser Nines, reject them, and make the next superior Place all ty more. Thus, for 17,1999 write 17,2; and for 12 write 13, &c.

## 47. ADDITION of DECIMALS

Addition and Subtraction in Decimals are performance after the same Manner as Sect. 2, 3, of whole Numbers, being taken, that like Parts be placed under one and and from their Sum or Difference cut off so many December as there are the most in any of the given Number as for Example, add 14,074, ,1476; 10,074, 21415,001247 together, placed thus:

14,074 ,1476 10,074 214,5 ,COI 247

Sum 238,796847

## EXAMPLES.

What is the Sum of,0476, 21,476, ,0067, ,64, 17,6, and ,20764?

Add ,427, 64,075, 27,6421, 10,8, ,0074, and 104,046842 together.

What is the Sum of ,274, ,076, ,64762, ,0706, ,47, ,007, and 968,42.

## 48. SUBTRACTION of DECIMALS.

## EXAMPLES.

What is the Difference between 17,0076 and ,947.

Thus { 17,0076

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Num 14.5 Diff. 16,0606

What is the Difference between 176, and 10,764? From 647, take ,00746.
What is the Difference between 74,6407 and 69.5?

## 49. MULTIPLICATION of DECIMALS.

Multiplication in Decimals is also performed as in Sect. of whole Numbers, no Regard being had to the Decimals such, till the Product is obtained, but then so many Decial Places must be cut off (with a Comma) from the Right and of the Product, as there are Decimals contained in the ultiplier and Multiplicand.

E X A M P L E S.

1. Multiply 74,674 by 12,768.

Mul-

and the fill

Multiplicator 7,4674 here are four } Decimal Places, which Multiplicand 12,768 here are three } added together make,

Product 95.3437632 fo then I cut off 7 Places here from the Right Hand.

2. Multiply, 17504 by 76. Mul. 27, 42, by 3, 56. 3. Mul. 8,04704 by, 2575. 4. Mul. 5745, by, 0675.

But if it happens, that when the Operation is finished there are not so many Figures in the Product, as there ough to be Decimal Places by the Rule, when this is the Case, you must supply the Defect, by prefixing Cyphers to the Les Hand of the Product, to make the Number of Places equal as in these

## EXAMPLES.

5. Mul., 4 by ,2.
6. Mul., 047 by, 046.
7. Mul., 000476 by, 00078.
8. Mul., 47 by, 0008.

## CONTRACTIONS.

- plied by 20, 100, 1000, &c. it is only removing the a parating Point in the Multiplicand, so many Places ward the Right Hand as there are Cyphers in the Multiplier.
- 9. Mul. 2.74 by 10. 10. Mul. ,2746 by 100. 11. Mul. 1976 by 1000. 12. Mul. ,42768 by 1000.
  - 2. When the Product will contain more Decimals the are necessary for the present Purpose, the Work me be contracted thus.

Write down the Multiplicand as usual, then write und it the Multiplier inverted, with the Units Place ther of under that Place of the Multiplicand, whose Playou intend the Product shall extend to; then multiplier as usual, by each Figure of the Multiplier, beginning with those of the Multiplicand which stand over neglecting those to the Right Hand, unless so far as observe what would arise from multiplying the gures immediately foregoing, which must be taken at the beginning of each Line, the first Figure of the particular Product must stand underneath one another.

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Let it be required to multiply 47,274649 by 37,4767, and let there be only four Places of Decimals.

Contracted.	Common Way.		
47,274649 Myltiplicand.	47,274649		
7674,73 Multiplier inverted.	37,4767		
14182395	33° 922543		
3309225	2836 47894		
189099	33° 22 2543		
33092	189° 98 596		
2836	33° 9225 43		
331	14182394 7		
1771,6978	1771,6978 381783		

The Reason of this Contraction will easily occur to any who considers the Work the common Way, as it stands we.

The perpendicular Line there drawn among the Figures, off all the superfluous Part of the Work to the Right and, and leaves the fignificant Part on the Lest, which an is to the contracted Part, so that the inverted Order must appear very plain.

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lote, in multiplying the Figure left out every Time, next Right Hand In the Multiplicand, if the Product be 5, or ards to 15, carry 1; if 15, or upwards to 25, carry 2, and 5, or upwards to 35, carry 3, &c.

Let it be required to multiply 3,47678, by 27,6782, and to have only three Places of Decimals in the Product.

Multiply 47,689464 by 26,17694 retaining five Deci-

## 50. DIVISION of DECIMALS.

vision of Decimals, the Work is also performed as in le Numbers, the only Difficulty is in valuing the Quowhich will be very easy by observing either of the solg (general) Rules.

#### R U L E.

Value with that Figure of the Dividend, which a fwers or stands over the Place of Units in the Dividend

2. The Quotient must always have so many Decimal R. ces, as the Dividend has more than the Divisor. To make the Rule more easy, I shall divide it into a Cases.

#### CASE I.

When the Decimal Places in the Divisor and Divide are equal, the Quotient will be whole Numbers.

Note, If there be a Remainder after all the Dividend gures are used, the Quotient may be continued to we Number of Decimals you please, by subjoining as pher continually to the last Remainder.

## EXAMPLES.

1. Divide 1735,5 by 6,5 2. Divide ,8332 by ,008 3. Divide 49,3066 by ,0574. 4. Divide 17,46 by ,47.

## CASE II.

When there are not so many Places of Decimals in Dividend as there are in the Divisor, annex Cypher make them equal, and the Quotient will be whole N bers.

## EXAMPLES.

5. Divide 186,9 by 7,476.
6. Divide 14,41 by ,18
7. Divide 104 by ,04.
8. Divide 6 by ,008.

### CASE III.

When the Place of Decimals in the Dividend of those in the Divisor, cut off the Excess for Decimal in the Quotient.

## EXAMPLES.

9. Divide 1229,47112 by 34. 10. Divide 754,4578 by 11. Divide 246,1476 by 604,25. 12. Divide 7,268401 b

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#### CASE IV.

If, after the Division is finished, there are not so many Fires in the Quotient as there ought to be Places of Decils by the general Rule, then so many Cyphers must be sixed to the left Hand of the Quotient as there are Places nting.

Divide 6,7258 by 647. 14. Divide,0008136 by 678. Divide,0072 by 12. 16. Divide,016728 by 2,46.

### CONTRACTIONS.

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When the Divisor is an Unit or 1, with any Number of phers, as 10, 100, 1000, &c. the Quotient will be the ne Figures as the Dividend, having the Decimal Point noved so many Places farther towards the Lest-Hand as ne are Cyphers in the Divisor.

Divide 24,6 by 10. 18. Divide ,4076 by 100. Divide 487,67 by 1000. 20. Divide 474,6 by 1000.

There is also a compendious Way of contracting the ork, reverse to that in Page 187, by which much Labour aved, especially when the Divisor hath many Places of cimal Parts in it; and is performed by the following

## RULE.

by the first Rule sind what is the Value of the first Field in the Quotient; then, by knowing the Denomination the first Figure, the Decimal Places may be reduced to Number proposed, by taking as many of the Left-Hand cures of the Dividend as will answer them, and in divident, omit, or prick off one Figure of the Divisor at h Operation, that is, for every Figure you place in the otient, prick off one in the Divisor; having a due Red to the Increase which would arise from the Figure so itted. (See Note in Page 187.)

E X A M P L E S. 67.760426

Let it be required to divide 642,17684, by 67.68426.

and retain four Places of Decimals in the Quotient.

Con-

	60915834 - 6	,7 <b>\$6</b> 426(642,176840	
	3301850	an Asia ta	
	2707370	330185	
	591480	270737	04
· C. L Y	547474	59447	960
	<b>.</b>	54147	State of the
	53006	4. 11 11 11 11 11 11 11 11 11 11 11 11 11	
	47379	,5300	
	3627	47378	100000000000000000000000000000000000000
1 1000		\$626	
eu Said	Later Commencer	5414	500
	212	Sarita ontine i p <del>er t</del> e	970
.091	d Agar, 203; (1 .8)	,211 20	I MUDICINE

22. Divide 913,08 by 2137,2 and let the Quotient of contain three Decimal Places.

23. Divide 6109, 2674 by 240,649 and let there be of four Places of Decimals in the Quotient.

24. Divide 165,9923. by 52,7438, and let there be o

## 51. REDUCTION of DECIMAL

### CASE I.

To reduce a Vulgar Fraction to a Decimal.

## RULE.

Add Cyphers to the Numerator, and divide by the nominator, the Quotient will be the Decimal Fraction quired.

## EXAMPLES.

1. Reduce 1 to a Decimal.
Thus 4)1,00(,25 the Decimal required.

2. Reduce 1 to a Decimal.

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Reduce  $\frac{3}{4}$ ,  $\frac{1}{8}$ , and  $\frac{1}{16}$ , to Decimals. Reduce  $\frac{5}{24}$  to a Decimal.

, Reduce 15 of 3 to a Decimal.

Reduce 4 to a Decimal.

. Reduce  $\frac{2}{3}$  to a Decimal.

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3. Re

Reduce 3 of 1 of 7 to a Decimal.

Reduce 1 of 15 to a Decimal.

## CASE II.

o reduce Coins, Weights, Measures, &c. into Deci-

#### RULE I.

educe the given Money, Weights, &c. into the lowest omination or Name mentioned, for a Dividend, then ce the Integer into the same Denomination for a Divithe Refult will be the Decimal required.

#### U L E II.

filte the given Denomination or Parts orderly under other, the inferior or least Parts being uppermost; hele be the Dividends. Against each Part on the left d, write the Number thereof contained in one of its fur; let these be Divisors. Then beginning with the t Denomination with Cyphers added (making a Dot een the Cyphers and the Figure) and divide, writing Quotient of each Division, as Decimal Parts on the Hand of the Dividend next below it: and let this Number be divided by its Divifor, and fo on, till all ished, and the last Quotient will be the Decimal re-

## RULE III.

reduce Shillings, Pence, and Farthings; if the Num-Shillings be even, take Half for the first Place of Des, and let the second and third Places be fitted up the Farthing contained in the remaining Pence and ing, always remembering to add 1, when they are 40 add 2: but if the Number of Shillings be odd, by them by 5, and proceed with the Pence and Faras before.

E X-

## EXAMPLES.

1. Reduce 171. 63d. to the Decimal of a Pound,

By Rule I.

Thus 17 61

210

1. .qrs. —

1=960)843,0(,878125, the Decimal required.

By Rule II. thus,	By Rule III. thus,
4)3,00 1414. 2 101 1010	175. 61d.
12)6,75	5 4 4
20)17,5625	85 27+1=28 1 U 28

,878125 the Decimal as before. ,878 the Decimal.

2, Reduce 61. gd. to the Decimal of a f.

3. Reduce gr. to the Decimal of a Guinea-

4. Reduce 14s. 61d. to the Decimal of a Moidore.

5. Reduce 18s. 41d. to the Decimal of a f.

6. Reduce & of a Penny to the Decimal of a f.

7. Reduce 11 dwts. to the Decimal of a lb. Troy.

8. Reduce 10 Drams to the Decimal of a lb. Avoid

9. Reduce 3 grs. 14 lb. to the Decimal of a cwt.

10. Reduce 6 Inches to the Decimal of a Yard.

11. Reduce 6 Furlongs to the Decimal of a League.

12. Reduce 18 galt. 2 qts. of Wine to the Decimal of

13. Reduce 3 qts. i pt. of Ale to the Decimal of a Ba

14. Reduce 8 Perches to the Decimal of an Acre.

15. Reduce 4 bush. 2 pks, to the Decimal of a Chald

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16. Reduce 12 Minutes to the Decimal of an Hour.

17. Reduce 12 Days to the Decimal of a Year (Julian

By this Rule the following Decimal Tables are mi

		Law School !	A commission of advance	Action to the second se		19	
Decim	ial TAE	BLES	of COIN	, WEIGH	T, and N	EASURE	
TA	BLE	I.	19	<b>•75</b>	TAB	LE III.	
Corn.		8	,666666		DUPOISE		
(Ster. the Interger		7	,583333	Tralb.	112lb. the Integ.		
1 de		I dec.	6	.5	Quart.	Decimal	
.9		,45	5	,416666	Zanti.		
0.0	5 8	•4	3	>383333	201	75	
1,8	NAME OF BUILDINGS	1.35	3	3.25	1 .72837	,25	
,8	6	1,3	2	,166666	3-13-11	MANUFACTURE	
,7.		,25	State Same	,083333	Pounds.	Decima	
1,7	4	, z	· 公司等等。基础的基础的公司	This Table	20	178571	
,6	5 3	,15	THE RESERVE OF THE PARTY OF THE	will alfo	10	,089286	
2,6	2	,1	ferve	for Inches	8 8	,08035	
1,5		,05	Mont	hs or Doz.		,071428	
1,5	11-		The state of the s		7	,0625	
nce.	Decin	al.	Penny	Decimals	•	,05357	
1	,045	200 100 200 000 000	weight.	1002201	5	,04464	
6	,041	666	10	.041666	4	,035714	
	,037		8.	,0375	3	,026780	
8	,033		THE RESERVE OF THE PROPERTY OF THE PARTY.	,033333		,017857	
	,029		7	,029166		1,000928	
5	,025			1925	Ounces.	Decimal	
0.0	,0208	333	1.5(m)	,020833	10	,00558	
	,0168		114	,016666	9.8	,005022	
	,0125		3	,008333		,004464	
	,008	33	ī	,004166	7	,003906	
	,0041	66	一下 一下		6	,003348	
th.	Decim	als	Grain.	Decimals.	5	,00279	
	,0031	Part of the second	20	,003472	4	,002232	
	,0020	83	10.	,001736	3	,001673	
	,0010	42	9	,001.562	25	,001116	
	20. 138	101	8	,001389		,000558	
A T	BLE :		6	,001215	Drams.	Decimals	
1000		и.		,001012	10	,000348	
OY	WEIGH	T.	5	,000694	<b>9</b> 8	,000313	
· th	e Intege	er.	3	,000521	2	,000279	
es.	Decim	ils.	2	,000347	7 6	,000244	
	19166		4:100	,000173	The state of the s	,000200	
	,8333		1.42 2 ren	,000086	5 4	,000174	
	The second second	and the second	Management when the same of	9	d Telegraph	,000139 De	

194	1-07	Company					
Decima	A STREET OF THE PARTY OF THE PARTY.	of COIN	, WEIGH	T, and			
3	,000104	9	,035714	Pints	Decim. \B		
2	,000069	8	,031746	4	.5		
I	,000034	7 6	,027	3	,375		
2	,000017	6	,023809	2	,25		
TAR	LE IV.	5	,019841	- P	,125		
	WEIGHT.	4	,015873	2 pt.	Dec:m. I		
	e Integer.	3	,011904	•3	,09375		
	Decimals	2	,007936	2	,0625		
Ounces.	Decimais	1	.003968	T	,03125		
8	,5	Pints.	Decimals.	Decin			
7 6	4375	4	,001984	100000000000000000000000000000000000000			
	,375	2	,001488	,015615			
5	,3125	2	,000992				
4	325	L Pra	,000496	,007			
3	,1875	An an incomplete of the	Symmetric and the second	Decin			
2 125			A Hogshead the		,005859		
	1 ,0625		Integer.		906		
Drams.	Decimals.	Gallons.	D. cimals.	,001	953		
8	,03125	30	,47619		De n		
7	,027343	20	,31746		BLE VI		
6	,023437	1 10	,15873		G MEASU		
5	,019531		,142857	I Mil	e the Inte		
4	,015625	9.6	1126984	Yard.			
3 2	,011718	0,000	STATITI	1000	,5681		
2 .	,007812	6	,095238	900			
1	,003906	5	,079365	800			
TD A III	1.0	4	,063492	700			
TABLE V.		3	,047619	600	THE RESERVE OF THE PARTY OF THE		
TO BUT THE PARTY OF THE PARTY OF	MEASURE.	2	,031746	500	ELANTH SECURITY AND AND ADDRESS.		
Innt	he Integer.	1	.015873	400			
sall ns.	Decimals.	Pints.		300	1704		
100	,396825		Decimals.	1 200	,1136		
90	,357141	3	3/1	100			
80	317462	2	,003968	90			
70	,27	2	,001984	80	TOTAL STREET,		
60	,238095			70			
50	,198412	TABLE VI.		60			
40	,15873	MEASURE.		50	0.		
30	,119047	Liquid. Dry.		40			
20	,079365	1 Gallon. 1 Quarter.		30	ALL THE TANK		
10	-,039682	The state of the s	teger.	20			

			11/-	- ;	N/F
Decim		of Col	N. WEIGH	T, and	MEASURE.
10	1,005682	4.1	,010959	Nails.	Decimals.
20.531 1 CW S C	,005114	3	,008219	3	,1875
8	,004545	2	,005479	2	,125
7	,003977	II	,002739	1 1	,0625
98 76	,003409	Day t	re Integer.		E
5	,002841	Hours.	Decimals.		elouisió
4	,002273			A CONTROL OF THE PARTY OF THE P	BLE X.
	,001704	20	,833333		WEIGHT.
3 2	,001139	10	,416666	I Fothe	r the Integer
	,000568	8	,375	3.4 13.1	
eet,	Decimals.	THE RESERVE OF	,333333	Hund.	Decimals.
		1. 7.	,291666	. 10	,51282
2	,0003787	6	,25	8	,461538
1	,0001804	15 9	,208333		,410256
nch.	Decimals.	4	,166666	7	,358974
6	,0000947	3	,125	6	,307692
3	,0000474	2	,083333	5	,25641
2	,000315	1	,041666	4	,205128
1	,0000158	Minutes	Decimals.	3	,153846
ITI A	N. D. XZIII	50	,034722	0 2	,102564
	BLE VIII.	40	,027777	-1	,051282
	TIME . / 3	30	,020833		
Yea	the Integer	20	,013888	Qrs.	Decimals.
ays.	Decimals.	.10	,006944	. 2	,025641
00	,821918		,00625	1	,01282
00	,547945	8	,005555	- 00:	
00	1,273963	7	,004861	Pounds	Decimals.
90 80	1,246575	6	,004166	14	,0064102
	F. M. W.	15 16 36	,003472	7.13	.0059523
70	,191781	4	,002777	712	,0054945
00	1,164383	130	,002083	11	,0050366
50	,136,986	1 2	,001388	110	,0045787
h	,109589	1	,000694	9	,0041200
3	,082192	TO A T		8	,003663
	1,054794	The state of the s	BLE IX.	7	,0032051
	0 1,027397		MEASURE	6	,0027472
	,024657		the Integer	7 6 5 4 3 2	,0022893
	,021918	Quart.	Decimals.	1 4	,0018315
	1,019178	3	75	3	1,0013736
3	,016438	2	5.	2	,0009157
	1,013609	1	,25	I	1,0001678

Sample C. W. Britanian

#### C A S E III.

To find the Value of any Decimal Fraction, in Money Weight, Measure, &c.

## RULE.

Multiply the Decimal by the Number of Parts of them inferior Denomination, cutting off so many Places for Decimals to the Right Hand, as your given Decimal confider and those to the Lest will be Integers; then multiply then maining Decimals by the next inferior Denomination, a cut off for Decimals as before; thus proceed till you he brought it into the least Parts of the Integer.

## EXAMPLES.

Thus, 878125

1. 17, 562500

82170 1.112

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Answer, 171. 62d. the Value require

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2. 6,7500

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grs. 3,00

. What is the Value of ,3375 of a &.

3. What is the Value of ,45 of a Guinea?

4. What is the Value of ,72708 of a Moidore?

. What is the Value of ,00243 of a lb. Troy?

. What is the Value of ,3375 of a Ton?

7. What is the Value of ,0396 of a lb. Avoirdupoile

8. What is the Value of ,875 of a cwt?

9. What is the Value of ,16669 of a Yard?

10. What is the Value of 259 of a League?

11. What is the Value of ,29365 of a hhd. of Wine?

12. What is the Value of ,875 of a Barrel of Ale?

3. What is the Value of ,05 of an Acre?

14. What is the Value of ,125 of a Chaldron of Con

15. What is the Value of, 4765 of a Day?

## 53. EXTRACTION of the SQUARE ROOT.

Extracting the Square Root is to find out such a Number being multiplied into itself, the Product will be equal to he given Number.

As the Square Root of 81 is 9, confequently 9x9=81 the

iven Number.

1.3 4 5 6 Roots. 9 | 16 | 25 | 36 | 49 | 64 |

To extract the Square Root of any Number observe the lllowing

#### U L E.

Point the given Number or Resolvend into Periods of two

Figures each, beginning at the Unit's Place.

Find by the Table the greatest Square Number that is contained in the first Period towards the Left Hand, placing the Square Number under the first Period, and the Root thereof in the Quotient (as in Division), subtract that Square out of the faid Period, and to the Remainder bring down the next Period for a Dividend.

Double the Quotient or Root, and place it for a Divisor, feek how often the Divisor is contained in the Dividend (referving always the Unit's Place), and put the Answer in the Quotient, and also on the Right Hand of the Divifor: then multiply the Divifor by the last Figure put in the Quotient (as in common Division), the Product subtract from the Dividend, and to the Remainder bring down the next Period, which proceed with as before.

te, But if it happens that the given Resolvend is not a perfect Square, Cube, &c. then fomething will remain after Extraction hath been made throughout all the Points; when this is the Case, you must annex Cyphers according as the proposed Power requires, viz. by Pairs or Twos in the Square; Threes in the Cube, &c. and

the Operations continued as before.

198 Extraction of the Square Root.

2. If the given Resolvend consists of a Whole Number as Decimals together, make the Number of Decimals en by adding Cyphers to them.

EXAMPLES.

1. Let it be required to extract the Square Root of 7477000

Thus 74770609(8647. the Root required: 64=the greatest Square in 74.

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1. Divisor 166) 1077 Dividend.
996=1724×4.

2. Divisor 1724),8106

6896=1724×4.

3. Divisor 17287) 121009 17287×7.

8647×8647=74770609, the Proof.

. What is the Square Root of 60516?

3. What is the Square Root of 7658?

. What is the Square Root of 39342864?

. What is the Square Root of 8200667940,529 F

6. What is the Root ,000729?

. What is the Square Root of 2 ?

What is the Square Root of 2,2710957?

Q. What is the Root of 36,00000625?

To extract the Square Root of Vulgar Fragrick

Reduce the Fraction or Fractional Parts to its lowell To and if it be a mixed Number, to an improper Fraction; it extract the Square Root of the Numerator for a new Num tor, and the Square Root of the Denominator for a new nominator.

and Charles B. XuA, M. P. L. E. S.

10. What is the Square Root of 288 2

21 42

Thus, First 25 neduced to its lowest Term is=5.

Then  $\sqrt{\frac{4}{3}} = \frac{2}{3}$  the Root required.

What is the Square Root of 1716?

First 17×25+16=44

Then Val = 21 or 41, the Root required.

What is-the Root of 25?

What is the Square Root of 225?

What is the Square Root of 1038?

What is the Square Root of  $\frac{4608}{272}$ ? What is the Square Root of  $\frac{260}{64}$ ?

What is the Square Root of 27-

### UR

To extract the Square Roots of Vulgar Fractions, when be Surds, i. e. a Number where a Root can never be guoreste and set to ally found.

## RULE

aduce the Fraction or Fractional Part to its lowest Terms. reduce it to a Decimal, and annex that Decimal to the ole Number (if any) and extract the Square Root there-

## EXAMPLE

What is the Square Root of 135?

Thus, First 135 reduced to a Decimal is, 213613.

Then 1,283613=,5325+. the Root required. tions become the in

What is the Square Root of 83?

What is the Square Root of \$27?

100

Ten

n i l Num

new

What is the Square Root of 7614?

The USE of the SQUARE ROOT.

## CA.S.E

da mean Proportion between any two given Numbers:

#### Fadi dua cres U L E.

ply the two given Numbers together, and extract are Root of the Product, which Root will be a mean and fought is closed a Circle of the leading

Dis A not love from Don't the District EXAMPLES,

## EXAMPLE 8.

Thus, First 9+4=36.

Then  $\sqrt{36}=6$ , the mean Proportion.

.. 4:6::6:9.

2. What is the mean Proportional between 67 and 124?

#### CASE II.

To find the Side of a Square equal in Area to any give Superficies.

R. U. L. E. and and fisher

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the Si

Extract the Square Root of the given Superfices, whi Root will be the Side of the Square fought.

EXAMPLES.

3. If the Area of a given Circle is 4276,5, I demand the si of a Square, whose superficial Content shall be equal thereto.

Thus \$\frac{2}{4276,5}=65,395, the Side of the Square required.

4. Suppose I have an elliptical or irregular Fish-Pond, of taining in Surface 9 Acres, 2 Roods, 15 Perches, a would have a square one of the same Content; I do you'd tell how many Yards each Side must be.

5. If the Content of a given Circle be 160, what is the

of a Square equal thereto?

## C' A 8 E HI. Pd distant

Having the Area of a Circle, to find the Diameter.

## RULE.

As 355: 452:: or, as 1: 1,273239:: fo is the Area to Square of the Diameter: or multiply the Square Root of Area by 1,12837, and the Product will be the Answer. See Problem 6, in Mensuration.

EXAMPLES.

6. Required the Diameter of a Circle that will comprise within its Circumference the Quantity of an Acre of

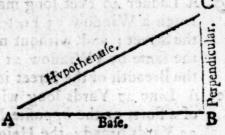
An Acre of Land contains 4840 square Yards, then 355: 2::4840:6162,4788 Square of the Diameter.

.. \$\square\$ \frac{7}{6162,4788} = 78,5 yds. the Diameter required.

In the Midst of a Meadow well stored with Grass,
I took just two Acres to tether my Horse;
How long must the Cord be, that feeding all round,
He mayn't graze less or more than these two Acres of
Ground.

#### C A S E IV.

Any two Sides of a right-angled Triangle, A B C, being wen, to find the remaining Side.



The Base and Perpendicular being given, to find the Hypothenuse.

## RULE.

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er.

Square each Side, add the Squares together, and the Square of this Sum gives the Hypothenuse required.

If the Hypothenuse and one Side be given, to find the other Side.

#### RULE.

From the Square of the Hypothenuse, subtract the Square the given Side, the Square Root of the Remainder gives side required.

## EXAMPLES.

At Matlock, near the Peak in Derbyshire, where are many surprising Curiosities in Nature, is a Rock by the Side of the River Derwent, rising perpendicular to a wonderful Height, which being inaccessible, and sound by a mathematical

Observation and the Foot of the Rock to be 55½ Ya and from the Top of the Rock to the faid Place, to 140½ Yards (nearly), required the Height of this pendous Work?

First 140,5×140,5=19740,25 Square of the Hypothe And 55,5× 55,5= 3080,25 ditto of the Base.

16660 Diff. of their Squares.

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79. A Ladder 40 Feet long may be fo planted, that it reach a Window 33 Feet from the Ground on one the Street; and, without moving it at the Foot, wi the same by a Window 21 Feet high on the other Street high of the Street is required?

of a Fort, on the opposite Bank of a River, known 23 Yards broad: the Height of the Wall is require

Distance between the Place of Observation and the of the Rock level with the Eye, and directly und Building, is given 310 Fathoms; the Distance the Top of the Rock to the Place of Observation in Fathoms; and from the Top of the Building 425 Height of the Edifice is required?

due East 50 Leagues, the other due North 84: He

are they afunder?

13. The Height of an Elm, growing in the middle of cular Island 30 Feet in Diameter, plumbs 53 Feet a Line, stretched from the Top of the Tree straig the hither Edge of the Water, 112 Feet: What is the Breadth of the Moat, supposing the Land on the Side the Water to be level?

14. Require the Length of a Shoar, that being to h

Feet from the Upright of a Building, will sup

Jamb 23 Feet 10 Inches from the Ground?

There are two Columns, in the Ruins of Persepolis, left sanding upright, one is 64 Feet above the Plane, the other 50; between these, in a right Line, stands an ancient Statue, the Head whereof is 97 Feet from the Summit of the higher, and 86 Feet from the Top of the lower Column; the Base whereof measures just 76 Feet to the Center of the Figure's Base: By these Notices, the Distance of the Top of the Column may be, by Numbers, easily found.

A Castle Wall there was, whose Height was found Tobe an hundred Feet from th' Top to th' Ground; Against the Wall a Ladder stood upright, Of the same Length the Castle was in Height.

A waggish Youth did the Ladder slide, (The Bottom of it) ten Feet from the Side; Now I would know how far the Top did fall, Bypulling out the Ladder from the Walllis I was walking out one Day, Which happened on the first of May,

As Luck would have it, I did fpy,

A May Pole raised up on high,

The which at first me much surpris'd,

Not being before-hand advertis'd

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Of such a strange uncommon Sight; Isaid I would not stir that Night, Nor rest content, until I'd sound,

Is Height exact from off the Ground; but when these Words I just had spoke, I Blast of Wind the May-Pole broke,

hose broken Piece I found to be mach in Length Yards fixty-three, which by its fall broke up a Hole, wice fifteen Yards from off the Pole; at this being all that I can do, he May Pole now being broke in two

bequal Parts, to aid a Friend, 4 Youths, pray then an Answer send.

### CASE V.

Number of Men being given, to form them into a lattle, or to find the Number of Ranks and Files.

RULE.

## R U L E.

Extract the Square Root of the Number of Men g will give the Number of Men either in Rank or File.

## EXAMPLE.

18. A General disposing his Army into a square Be finds he has 23716 Men; required the Numberial and File.

### 55. The EXTRACTION of the CUBE ROOT

To extract the Cube Root is to find out a Number, we being multiplied into itself, and then again into the Proproduceth the given Number.

As the Cube Root of 729 is 9, consequently 9×9×9= the given Number, and so of others, as in the following I

Rnots.	1	2	1. 3.	4	1 5 m	6	7	1 8 1
Cube.	1	8	27	64	125	216	343	512

## R U.L.E. tod blow bid

at the Units Place, feek the greatest Cube to the Point on the Left Hand (by the Table) whose place in the Quotient, then subtract its Cube sto Period, and to the Remainder (if any) bring down three Figures, or your next Period, and call in Dividend.

2. Find a Divisor by calling your Quetient Figure,
Cypher joined to it, r; then three Times the Squer will be your Divisor, seek how often it is contained the Dividend, and put the Answer in the Quotien Division, only with this Difference: call the said tient Figure last put up e, and multiply your Division, and place the Produce underneath the Divident multiply the Squere of e, by three Times r, and also under the Dividend; lastly, cube the Figure

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the e, and place it under the Dividend: then add the three Products together, gives the Subtrahend, which subtract from your last Dividend, and to the Remainder bring down the next Period, and proceed as before.

#### EXAMPLES.

What is the Cube Root of 21024576?

21024576(276, the Root required.

N=1200) 13024

8400= 3rre } here r, is 20, and e, 7.

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1312200=3rre 29160=3rre 216= eee } here r, is 270, and e, 6.

1341576

hat is the Cube Root of 92398647.

hat is the Cube Root of 91?

hat is the Cube Root of 67527834239?

hat is the Cube Root out of 4764,75.

he Solidity of a Cube is 36155,027576 Inches, what is side of that Cube?

hat is the Side of that Cube, which contains 667,921875 folid Inches?

hat is the Cube Root of 219365329?

hat is the Cube Root of 3105926,917?

hat is the Cube Root of,000421875?

12. What is the Side of a Cube, whose Solidity 28022810,390625?

To extract the CUBE ROOT of a VULGAR FRACTION

Note, the same Rules, with regard to Fractions, which given in Page 197, must be observed here, only exting the Cube Root instead of the Square; that is, duce the Fractions to their lowest Terms; if it mixed Number, to an improper Fraction; and if a S to a Decimal.

#### EXAMPLES.

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13. What is the Cube Root of 124 ?

14. What is the Cube Root of 352?

15. What is the Cube Root of 5 1 0 4?

16. What is the Cube Root of 405125?

#### SURDS.

17. What is the Cube Root of 53?

18. What is the Cube Root of 75?

## 56. The USE of the CUBE ROOT.

#### CASE I.

To find the Side of a Cube that shall be equal in Soli to any given Solid, as a Globe, Cylinder, Prism, Cone,

#### R U L E.

Extract the Cube Root of the folid Content of the Body, which Root will be the Side of the Cube required

#### EXAMPLES.

folid Feet, what is the superficial Content of one Sides.

#### CASE II.

Having the Dimensions of any solid Body, to find the mensions of another Similar Solid, that shall be Number of Times greater or less than the Solid given.

R U

#### RULE.

Multiply the Cube of each Side by the Difference between solid given and that required, if g eater (or divide by the ifference if less) than the Solid given: then extract the be Root of each Product or Quotient, which will give the imensions of the Solid required.

#### EXAMPLES.

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n. U Suppose the Length of a Ship's Keel to be 125 Feet, the Breadth of the Midship Beam 25 Feet, and the Depth of the Hold 15 Feet; I demand the Dimensions of another Ship of the same Form, that shall carry three Times the Burthen?

Again, I demand the Dimension of another Ship of the same Form, that shall only be Half the Burthen of that whose Dimensions are given as above?

#### CASE III.

Having the Dimensions and Capacity of a Solid, to find Dimensions of a similar Solid of a different Capacity.

#### RULE.

Like Solids are in triplicate Portion to their homologous des, therefore it will be as the Cube of a Dimension: is its given Weight:: so is the Cube of any like Dimension to the Weight sought.

#### EXAMPLES.

Fa Ship of 300 Tons Burthen be 75 Feet long in the Keel, I demand the Burthen of another Ship, whose Keel is 100 Feet long.

Suppose a Ball of 4 Inches Diameter weighs 18lb. I demand

the Diameter of another that weighs 114lb.

If a Brass Saker, whose Diameter is 11,5 Inches, weighs
1000lb. what will another Piece of Ordnance (of the same
Metal and Shape) weigh, whose Diameter is 20,83
Inches?

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#### CASE IV.

To find two mean Proportionals between two given Numb

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Divide the greater Extreme by the less, and the Cube R of the Quotient multiplied by the less Extreme gives lesser Mean; multiply the said Cube Root by the lesser M and the Product will be the greater mean Proportional.

#### EXAMPLES.

1. What are the two mean Proportionals between 7 and 1

2. Find two mean Proportionals between and 246. /a

The Bi quadrate of any Number is found by extracting Square Root of the given Number first, and then the Sq. Root of that Root.

Thus, let it be required to extract the Biquadrate Ro

First \$\frac{2}{4857532416} = 69696.

Then \$\frac{2}{69696} = 264 the biquadrate Root required.

The Root of the Square cubed, or fixth Power of Number, is found by extracting the Square Root of the Number, then extract the Cube Root of that Square I which will give the fixth Power required.

Thus, let it be required to extract the square cubed of 49656.

First  $\sqrt{49656} = 216$ . Then  $\sqrt{216} = 6$ , the square of Root required.

The Root of the Biquadrate squared, or eighth Pow found by first extracting the Square Root of the given in ber, which will reduce it to a Biquadrate, which proceed as before directed. Thus, let it be required to extract or find the Root of the with Power out of 43046721.

First  $\sqrt[2]{43046721} = 6561$ . Again  $\sqrt[2]{6561} = 81$ .

Also  $\sqrt[2]{8}$ 1=9, the Root of the eighth Power.

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The Root of the Cube cubed, or ninth Power of any Numn, is found by extracting the Cube Root of the given Numn, and the Refult will be a cubic Resolvend, or extract the the Root also, which will be the Root of the ninth Power.

Thus, let it be required to extract or find the Root of the inth Power of 387420489.

First  $\sqrt[3]{387420489} = 729$ . Then  $\sqrt[3]{729} = 9$  the Root of spinth Power.

The Extraction of the first and second Sursolids, i. e. the shand seventh Powers, will prove too difficult a Task in mmon Numbers; I would therefore advise the Tutor to an his Pupils only the Square and Cube Roots here, as ey are the most useful, and, in short, as high as is required all common Things. Besides, the Reason of the Thing anot be shewn till the Pupil comes to the Algebraic Part, here it will be easily performed, and appear more evident.

The SINGLE RULE of THREE in DECIMALS.

#### RULE.

Reduce the Fractional Parts into Decimals of the highest me mentioned; then state the Question and proceed as in st. 12, and 13.

#### EXAMPLES.

Suppose I give 6s. 3d. for 43 Yards of Cloth; what will 481 yds. of the same come to at that Rate?

T 3

First

First 4=4,75 yds. 6s. 3d=6,25s. and 48 48,5 yds.

Then If 4,75: 6,25: 48,5

4,75)303,125(=63,8+=31. 3s. 91d. the Answer

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2. If 2½lb. of Tea cost 11. 51. what will 14¾lb. come to the same Rate?

3. If 1lb. of Sugar cost 113d. what will 4 hhds. e weighing Net 4 cwt. 2 qrs. 14lb. cost at the si Rate?

4. A Grocer buys 4 Chests of Tea, each weighing N cwt. 3 qrs. 14lb. for 906l. 10s. at what Rate did he

per lb.

5. An Oilman bought 4 Tuns, 201½ Gallons, of Flore Oil for 2401. 16s. 6d. but by Misfortune it chan to leak out 24½ Gallons: I defire to know at whe must sell the Remainder per Gallon to be no Lose

6. Goliath is faid to have been 6 Cubits and a Half, 6 Span, high; this answers to 10 Feet 4 Inches 74: Pray what was the Length of the Cubit in Br

Meafure?

7. In a Series of proportional Numbers, the field is 5, third 8; the Product of the second and third is 7. What is the Difference of the second and fourth?

8. If the cubic Inch of Oil Olive be, 52835 Decimal I of an Ounce Avoirdapoise: What Quantity of weighing 7 lb. per Gallon, will be contained in a allowed to hold 13 Gallons of Water, each 282 Inches?

yhat Difference is there, in point of Weight, bet a Figure containing a folid Foot and Half of S and another of equal Dimensions in Brass 4,6 whereof make a Cubic Inch.

greater is in Proportion as 8 to 5: What is their and the Product of their Sum and Difference their rence and Product of their Squares, and the Sum

Square of their two Quotas, the greater divided by the less, and again the less by the greater?

There are two Numbers more, the greater 224, bearing Proportion to the other as 8 to 7: What is the Square of their Sum, Difference, and either Quota? What is the Refult of the Square of the Sum of the Difference, added to the Product of their Sum and Difference?

If during the Tide of Ebb, a Wherry should set out from London westward, and at the same Instant another should put off at Chertsey for London, taking the Distance by Water at 34 Miles: The Stream forwards one and retards the other, say, z½ Miles an Hour: The Boats are equally laden, the Rowers equally good, and in the ordinary Way of working, in still Water, would proceed at the Rate of 5 Miles an Hour: The Question is, where in the River the two Boats would meet? A Bullet of cast Iron, 4 Inches Diameter, weighs expe-

rimentally 9lb. What is the Difference of the Weight of one that is 13½ Inches in Diameter, and another that is no more than 7½ Inches?

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A gay young Fellow had 18200/. left him by an old Uncle, to whose Memory he expended three per Cent. of his whole Fortune, in a sumptuous Funeral and Monument: 9 per Cent. of the Remainder he made a present of to his Cousins, forgotten for his Sake by the old Man: with <sup>2</sup>/<sub>7</sub> of what was left, he bought a fine Seat; with <sup>1</sup>/<sub>8</sub> of the Residue a Stud of Horses; he squandered away 550/. upon one Mistress; and after he had lived at the Rate of 2000/. a Year for 19 Months together, he hath both ruined his Health and impaired his Fortune: Pray, at his Death, what was there left for his Sister, who was his Heir at Law?

The EFFECTS of LIGHT and HBAT.

Reflects or Degrees of Light, Heat, and Attraction, are meally proportional to the Squares of their Distances the Center, whence they are propagated.

15. Suppose that in a Room, where two Men, A and B, fitting, there is a Fire, from which A is three Feet, B is fix Feet distant, it is required to find how me hotter it is at A's Seat than at B's.

16. Supposing the Earth to be 81000000 Miles distant for the Sun; I would know at what Distance from I another Body must be placed so as to receive Light

Heat, double to that of the Earth?

81000000 of Miles, the Distance between Jupiter the Sun 424000000 of Miles, the Degree of Light Heat received by Jupiter, compared with that of

Earth is required?

18. Mercury, the nearest of the Planets to the Source of H Light, and Life in our System, the Sun, is about Millions of Miles from him; Saturn, the remote the Planets, is usually distant about 777 Million Miles: what Comparison or Proportion is there between the Solar Instruences on these two Bodies? con

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19. Suppose, with Dr. Keil, the Distance of the Sunt from us 115 of his Diameters; how much hotter then at the Surface of the Sun than under our Equa

20. A Ball, descending by the Force of Gravity, from Top of a Tower, was observed to fall Half the Wathe last Second of Time; required the Tower's He and the whole Time of Descent.

The less porous a Body is, the greater is its Density

the Earth, as 132½ is to 100: What Proportion to there between the Quantity of Matter in the Earth that in the Moon, fince the Earth's Diameter is Miles, and that of the Moon 2170?

Inhahitants the Moon doth always appear to be enlightened, when the is least enlightened, and least, when most, according to Gordon's Geograf Grammar; admitting the mean Distance of the

and Moon's Center's 24000 Miles, in what Proportion is this Illumination?

Velocities acquired by heavy Bodies falling.

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The Velocity acquired by heavy Bodies falling near the face of the Earth, is 16½ Feet in the first Second, and as Feet are to the Square of one Second, or 1, so is the gial Distance to the Square of the Seconds required; or, on contrary, to determine what Space a heavy Body has sed in any Time given, is,

hymultiplying 16½, the Descent of a heavy Body in one und of Time, by as many of the odd Numbers, beginning in Unity, as there are Seconds in the given Time, viz. In for the first, 3 for the second, 5 for the third, 7 for south, &c. the Sum Total will give the Space it hath sed.

Suppose a Stone let go into Abys should be stopped at the End of the eleventh Second after its Delivery, what Space would it have gone through?

What is the Difference between the Depth of two Wells, into each of which should a Stone be dropped at the same Instant, one will meet with the Bottom at 6 Seconds the other at 10?

If a Stone be 19½ Seconds in descending from the Top of a Precipice to the Bottom, what is the Height of the same?

In what Time would a Musquet-Ball, dropped from the Top of Salisbury Steeple, said to be 400 Feet high, be at the Bottom?

If a Hole could be bored through to the Center of the Earth, in what Time after the Delivery of a heavy Body on its Surface, would it arrive at its Center?

The DOUBLE RULE of THREE in DECIMALS.

when the Wine is fold at the Rate of 251. 4s. per hhd.

how many Persons will 11. 125. worth serve, when Wine is sold after the Rate of 18 Guineas per hhd?

2. If 6lb. of Pepper be worth 13lb of Ginger, and 19lb. this be worth 41lb. of Cloves, and olb. be equivale to 63lb. of Sugar at 5d. per lb. what is the Value of cwt. of Pepper?

3. What Money, at 41 per Cent. will clear 81. 25. 6d. in

Year and a Quarter's Time?

## QUESTIONS for EXERCISE at Leifure Hours.

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4. A lent his good Friend B fourfcore and eleven Guine from the 11th of December to the 10th of May following; B, on another Occasion, let A have 100 Mar from September 3 to Christmas following: Query, have long ought the Person obliged to let his Friend use a fully to retaliate the Favour?

D, in 14; C, D, and A, will do it in 15; and D, and B, in 18, in what Time will it be done by a

them together, and by each of them fingly?

6. A young Hare starts 5 Rods, before a Greyhound, an not perceived by him till she has been up 34 Secon she scuds away at the Rate of 12 Miles an Hour, the Dog, on View, makes after her at the Rate 20: how long will the Course hold, and what Growill he run, beginning with the Out-setting of Dog?

## 58. VIBRATIONS of PENDULUMS

It hath been found by Experiment, that a Pendulum Inches long, in our Latitude, vibrates 60 Times in one nute; and that the Length of the Pendulums are to one other reciprocally as the Square of the Number of their brations made in the same Space of Time.

7. What Difference is there between the Length of a Per hum that wibrates Half a Second, or 120 Times

Minute, and another that swings double Seconds, or to Times in a Minute?

Recip. As 3600: 39,2:: \[ 900: 156,8 \]

147 Inches,

or 12 Feet, 3 Inches. Q. E. F.

What Difference will there be in the Number of Vibrations made by a Pendulum of 6 Inches long, and another of 12 Inches long in an Hour's Time?

What Difference is there in the Length of two Pendulums, the one swings 30 Times, the other 100 Times in

an Hour?

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Give the Length of a Pendulum that will swing once in a Third, ditto in a Second, ditto in a Minute, ditto

in an Hour, ditto in a Day?

Observed, that while a Stone was descending to measure the Depth of a Well, a String and Plummet, that from the Point of Suspension, or the Place where it was held, to the Center of Ascillation, or that Part of the Bob, which being divided by the circular Line, struck from the Center abovesaid, would divide it into two Parts of equal Weight, measured just 18 Inches, had made 8 Vibrations; Pray what was the Depth, allowing the same as in Page 73 for the Return of Sound to the Ear?

### 59. FELLOWSHIP.

w to perform FELLOWSHIP, either Single or Double, without that tedious and laborious Task of making so many different Statings as there are Persons concerned.

#### RULE.

Divide the whole Gain or Loss by the whole Stock.

The Quotient multiplied by each Person's particular Stock, and the several Products will be the respective Gain or Loss of each.

Note,

Note, This Rule is best adapted for Decimals.

## EXAMPLES.

B 450% and C 300% with which they Trade a contain Time, and, when they balance Accounts, first that they have gained 300%. What is the Share each?

First 750+450+300=1500, the whole Stock.

And 3001.-1500=,2 the Quotient.

Then 
$$\begin{cases} 750 \text{ A's} \\ 450 \text{ B's} \\ 300 \text{ C's} \end{cases}$$
 Stock  $\times$ ,  $2 = \begin{cases} 150 \text{ A's} \\ 90 \text{ B's} \\ 60 \text{ C's} \end{cases}$  Gain.

Proof £. 300

2. Three Merchants A, B, and C, traded together; Apr in 1201. for 8 Months, B 2501. for 4 Months, and Ci for 5 Months; they gained 1841. 10s. What is ea Man's Share of the Gain?

First 
$$\begin{cases} 120 \\ 250 \\ 100 \end{cases} \times \begin{cases} 8 \\ 4 \\ 5 \end{cases} = \begin{cases} 960 \text{ A's} \\ 1000 \text{ B's} \\ 500 \text{ C's} \end{cases}$$
 Stock and Time.

Sum 2460) 184,5(,075, the Quotien

Then 
$$\begin{cases} 960 \\ 1000 \\ 500 \end{cases} \times .075 = \begin{cases} 72 & A's \\ 75 & B's \\ 37.5 & C's \end{cases} Gain.$$

Proof L. 184,5=1841. 101.

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Once as I walked upon the Banks of the Rye, To see the purling Streams glide gently by, And hear the pretty Birds to chirp and fing, Making the Groves with Melody to ring; I, in the Meads, three beauteous Nymphs did fpy, That for their Pleasure came as well as I; And unto me their Steps they did direct, Saluting me with most benign Respect. Saying, Well met, we've Business to impart, Which we cannot decide without your Art: Our Grannum's dead, and left a Legacy, Which is to be divided amongst three; In Pounds it is two hundred twenty-nine, Alfo a good Mark, being Sterling Coin. Then spake the eldest of the lovely three, I'll tell you how it must divided be ; Likewise our Names I unto you will tell, Mine is Moll, the others Anne, and Nell. As oft as I five and five-ninths do take, Anne takes four and three-fevenths her Part to make ; As oft as Anne four and one-ninth does tell, Three and two-thirds must be took up by Nell.

For more Examples fee Sect. 23 and 24.

Simple Interest, Annuities or Pensions, &c.

60. 1. SIMPLE INTEREST.

Here are five Letters to be observed, viz.

Fany Principal or Sum put to Interest.

the Interest.

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On

the Time of the Principal's Continuance at Interest. the Amount, or Principal and its Interest. the Ratio, or Rate per Cent. per Annum.

Note.

Note, The Ratio is the Simple Interest of 11. for one Year, any given Rate; and is thus found,

1. 1. 1. 1.

Viz. 100: 5:: 1:,05 the Ratio at 5 per Cent. per Ann Or 100: 6:: 1:,06 the Ratio at 6 per Cent. per Annu &c.

And in this Manner the Ratios in the following Table found.

## T A B L E.

3 =,03	$4^{\frac{1}{2}} = ,045$
3=,035	5 =,050
4 =,04	

When the Principal, Time, and Rate per Cent. are gi to find the Interest.

#### RULE.

Multiply the Principal, Rate, and Time continually one another, the Product is the Interest fought.

Or, if p=the Principal, t=the Time, r=the Rate, I=the Interest, then the Theorem will be as follows.

THEOREM I. ptr=I.

#### EXAMPLES.

1. What is the Interest of 4641. 10s. for 3 Years, at Cent. per Annum?

Performed thus, 464,5=p. 3=t.

1393,5=pt.

Answer 691. 13s. 6d.

69,675=pir.

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Wha

per

What is the Interest of 260l. 17s. 6d. for 51 Years at 41 per Cent. per Annum?

What is the Interest of 851. for 41 Years, at 5 per Cent.

per Annum?

gi

e,

t

What is the Interest of 1000l. for 4 Years and 8 Months,

at 51 per Cent. per Annum?

What is the Interest of 500l. from May the 12th, 1764, to November the 24th, 1769, at 34 per Cent. per Ann.?

61. When the INTEREST required is for DAYS only.

#### RULE.

Multiply the Interest of 11. for one Day, at the given Rate, whe Principal and Number of Days, it will give the Answer.

The Interest of 1/. for one Day, is thus found,

1. d.

Viz. As 365: ,05::1:,0001369863, &c. Or 365: ,035:: 1:,00009589041, &c.

#### A B L E.

per Cent. Decimals. 3 =,00008219178 3=,00009589041 4 =,00010958904  $4\frac{1}{2}$ =,00012328767 5 =,0001369863

## XAMPLE

What is the Interest of 3701. for 140 Days, at 5 per Cent. per Annum?

,0001369863=r. 370=p.

> 050684931=pr. 140=t.

Answer 7, 09589034=ptr.=7l. 1s. 11d.+.

U 2

7. What

7. What is the Interest of 3701. 10s. for 220 Days, at per Cent. per Annum?

8. What is the Interest of 600% from the 1st of July, 176 to the 24th of February following, at 6 per Cent?

When the Principal, Time, and Rate per Cent. are give to find the Amount.

#### RULE.

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Find the Interest by Theorem 1, which, added to the Principal, will give the Amount.

Thus, THEOREM 2. ptr+p=A.

#### EXAMPLES.

9 What will 2841. 10s. amount to in 7 Years, at 31 Cent. per Annum?

10. What will 6721. 5s. amount to in 51 Years, at 41

Cent. per Annum?

per Cent. per Annum?

When the Rate, Time, and Interest are given, to find Principal.

#### RULE.

Divide the Interest by the Product of Rate and Time, Quote is the Principal.

Thus, THEOREM 3. 1 = p.

#### EXAMPLES.

12. I demand, what Principal, being put to Interest Years, will gain 691. 135. 6d. at 5 per Cent. per A

Years, will gain 641. 75. at 4½ per Cent. per Annur

Years, will gain 641. 75. at 42 per Cent. per 14. I demand, what Principal, being put to Interest Years, at 4 per Cent. will gain 671. 155. 93d.

When the Amount, Rate, and Time are given, to find the Principal.

#### RULE.

Add 1 to the Product of the Rate and Time, and by that sum divide the Amount, the Quote is the Principal.

Thus, THEOREM 4. 
$$\frac{a}{tr+1} = p$$
.

## EXAMPLES.

5. What Principal, being put to Interest, will amount to 354l. 4s. ½d. in 7 Years, at 3½ per Cent. per Annum?

6. What Principal, being to Interest, will amount to 500l.

9s. 3¼d. in 6 Years, 5 Months, at 5 per Cent. per Ann.

7. What Principal, being put to Interest for 7 Years, 220 Days, at 4¾ per Cent. per Annum, will amount to 100l.

When the Principal, Interest, and Rate are given, to find

#### RULE.

Divide the Interest by the Product of the Principal and ate, the Quote is the Time.

Thus, THEOREM 5. 
$$\frac{I}{pr} = t$$
.

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#### EXAMPLES.

In what Time will 464l. 10s. gain 69l. 13s. 6d. at 5 per Cent. per Annum?

In what Time will 260l. gain 64l. 7s. at 41 per Cent.

In what Time will 500l. gain 130l. 9s. 7d. at 6½ per Cent. per Annum?

When the Principal, Interest, and Rate are given, to find

#### RULE.

Divide the Amount less the Principal, by the Product of the cipal and Rate, the Quote is the Time.

J 3

Thus

Thus, THEOREM 6, 
$$\frac{a-p}{pr}=r$$
.

#### EXAMPLES.

21. In what Time will 284l. 10s. amount to 354l. 4s. 1d. 31 per Cent. per Annum?

22. In what Time will 6721. 5s. amount to 8471. 17s. 6d.

23. In what Time will 378/. 18s, amount to 500/. 9s. 31 at 5 per Cent. per Annum?

When the Principal, Interest, and Time are given to st the Rate per Cent.

#### RULE.

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Divide the Interest by the Product of the Principal a Time, the Quote is the Rate.

THEOREM 7. Thus 
$$\frac{I}{pt} = r$$
.

#### EXAMPLES.

24. At what Rate per Cent. will 4641. 10s. gain 691. 13s. 6 in 3 Years?

25. At what Rate per Cent. will 2601. gain 641. 75. in Years?

26. At what Rate per Cent. will 5601. 125. 81d. gain 23 95. 4d. in 7 Years?

When the Principal, Amount, and Time are given, to f

#### R U L E.

Take the Difference between the Amount and Principal and divide it by the Product of the Principal and Time, Quote is the Rate.

Thus, THEOREM 8. 
$$\frac{a-p}{pt}=r$$
.

## EXAMPLES.

27. At what Rate per Cent. will 2841. 101. amount to 3.
41. 1d. in 7 Years?

At what Rate per Cent. will 378/. 18s. amount to 500/.

9s. 34d. in 6 Years?

o. At what Rate per Cent. will 6721. 5s. amount to 8471.

## 62. Of ANNUITIES, PENSIONS, &c. in ARREARS, At SIMPLE INTEREST.

An Annuity is a yearly Income arising from Money, &c. adis either paid for a Term of Years, or upon a Life.

Annuities or Pensions are said to be in Arrears, when make are payable or due either Yearly, Half-Yearly, or warrerly, and are unpaid for any Number of Payments.

Here U represents the Annuity, Pension, or Yearly Rent, T, R, as,

When U, R, T, are given to find A.

THEOREM 9. 
$$\frac{ttu-tu}{2} \times r: +tu = A$$
.

When the Annuity, &c. is to be paid Half-Yearly, or unterly, then for Half-Yearly Payments, take Half the mo, Half the Annuity, &c. and twice the Number of ars; and for Quarterly Payments take a fourth Part of Ratio, a fourth Part of the Annuity, and four Times the mber of Years, which work with as per Theorem.

#### EXAMPLES.

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If a House be let upon Lease for 7 Years, at 801. per Annum, what will be the Amount of the whole Time, at 4 per Cent. per Annum?

This given u=80, t=7, and r=,04 to find A.

Theorem 
$$\frac{ttu-tu}{2} \times r: + tu = \frac{7 \times 7 \times 80 - 7 \times 80}{2} \times 04: +$$

80=627.2=6271. 4s. the Amount required.

16 Years, what will it amount to in that Time, at 3 per Cent. for each Payment as it becomes due?

16 a Salary of 2501. payable every Half-Year, remain impaid for 6 Years, what would it amount to in that Time, at 3 per Cent. per Annum?

4. If

4. If a Salary of 2501. payable every Quarter, was left u paid for 6 Years, what would it amount to in the Time, at 3 per Cent. per Annum?

It may be observed by comparing the Answers of the the last Examples, that the half yearly Payment is more advantageous than the Yearly one, and also the Quarterly me than the Half-Yearly.

When A, R, and T, are given to find U.

THEOREM 10. 
$$t = U$$

When the Payments are Half-Yearly, take 4 a. if Quart 8 a, and proceed with the Ratio and Time as before.

#### EXAMPLES.

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5. Suppose a House to be let upon Lease for 7 Years, the Amount for that Time is 6271. 4s. at 4 per C what is the Yearly Rent?

6. If a Salary payable Yearly amounts to 16121. 101.
Years, at 3 per Cent. what is the Salary?

7. The Amount of a Salary payable Half-Yearly f Years, at 3 per Cent. is 16231. 155. what is the lary?

8. If the Amount of an Annuity, payable Quarterly 16291. 7s. 6d. for 6 Years, at 3 per Cent. what i

Annuity?

When U, A, and T, are given, to find R.

THEOREM 11. 
$$\frac{2a-2ut}{utt-ut}$$
=R

When the Payments are Half-Yearly, take 4a-4ut Dividend, if Quarterly, take 8a-8ut, and proceed the Annuity and Time as is mentioned in Theorem 9.

### EXAMPLES.

direction 1 by an indicate the

9. If a House be let upon Lease for 7 Years, at 80 Annum, and the Amount for that Time be 627 what is the Rate per Cent?

If a Salary of 250l. per Annum, amounts to 1612l. 10s. in 6 Years, what is the Rate per Cent?

If a Salary of 2501. per Annum, payable Half-Yearly amounts to 16231. in 6 Years, what is the Rate per Cent?

Suppose a Pension of 250l. per Annum, payable Quarterly, amounts to 1629l. 7s. 6d. in 6 Years, what is the Rate per Cont?

When U, A, and R, are given, to find T.

when 12. First 
$$\frac{2}{r} - 1 = X$$
. Then  $\sqrt{\frac{2a}{ur} + \frac{xx}{4}} = \frac{x}{2} = T$ 

When the Payments are Half-Yearly or Quarterly, prolwith the Ratio and Annuity, as mentioned before, and will be equal to those Half-Yearly or Quarterly Paylts.

#### EXAMPLES.

Is a House be let upon a Lease for a certain Time for sol. per Annum, and the Amount be 6271. 4s. at 4 per Cent. I desire to know the Time it was lest for?

In what Time will a Salary of 2501. per Annum amount

to 1612/. 101. at 3 per Cent. ?

If an Annuity of 250l. per Annum payable Half-yearly amounts to 1623l. 15s. at 3 per Cent. what Time was the Payments forborne?

fan Annuity of 2501. per Annum, payable Quarterly, mounts to 16291. 7s. 6d. at 3 per Cent. what was the

Time of Forbearance?

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PRESENT WORTH of ANNUITIES, &c.

the P represents the present Worth; U, T, and R, as

When U, T, and R, are given to find P.

THEOREM 13. 
$$\frac{t_1r-t_1+2t}{2t_1+2}$$
: × U=P.

fame is to be observed here for Half-Yearly and terly Payments, as before mentioned.

#### EXAMPLES.

17. What is the present Worth of a House, whose year Rent is Sch. per Annum, to continue 7 Years at 4 I Cent?

Here u=80, t=7, and r=0.04; then per Theorem.

$$\frac{tir-tr+2t}{2ir+2}: \times u = \frac{7 \times 7, c_4 - 7 \times 5, c_4 + 7 \times 2}{7 \times 5, c_4 \times 2 + 2}: \times 80 = \frac{7 \times 7, c_4 - 7 \times 5, c_4 + 7 \times 2}{7 \times 5, c_4 \times 2 + 2}: \times 80 = \frac{15, 68}{25, 50}: \times 80 = \frac{15, 68}{25, 50}:$$

56,125×80=490l. the present Worth required.

18. What is the present Worth of 2501. per Annum, continue 6 Years, worth in ready Money to continue Years?

19. What is a Pension of 2501 per Annum worth in res Money, payable Half-Yearly, at 3 per Cent. for Years?

20. What is the present Worth of 2501. payable Quarter for 6 Years, at 3 per Cent?

When P, T, and R, are given to find U.

THEOREM 14. 
$$tr+1$$
:  $\times 2p=U$ 

When the Payments are Half-Yearly, multiply by a for Quarterly by 8 p. and proceed with t and r as bef directed.

### EXAMPLES.

I defire to know the yearly Rent, when the present Wo is 490! at 4 per Cent?

produces 1366l. 10s. 6d. present Worth, at 3 Cent?

23. There is an Annuity payable Half-Yearly, for 6 Ye to come; what is the yearly Income, when the pre Worth, at 3 per Cent. is 13761. 55.?

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There is an Annuity payable Quarterly for 6 Years to come; what is the yearly Income, when the prefent Worth is 13801. 175. 6d. at 3 per Cent?

When U, P, and T, are given to find R.

THEOREM 15. 
$$\frac{\overline{ut-p}\times 2}{2pt+ut-utt}=R.$$

When the Payments are Half-Yearly, or Quarterly, proed with the Annuity and Time as before directed, and the potient will be the Answer accordingly (i. e.) if for Halfearly, the Quotient will be half the Ratio, and if for harterly, a fourth Part of the Ratio.

#### EXAMPLES.

Mat what Rate per Cent. will an Annuity of 801. per Annum, to continue 7 Years, present Worth of 4901?

6. At what Rate per Cent. will an Annuity of 2501. per Annum, to continue 6 Years, produce the present

Worth of 13661. 10s. 6d.?

If an Annuity of 250l. per Annum, payable Half-Yearly, having 6 Years to come, is fold for 1376l. 5s. what

is the Rate per Cent?

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At what Rate per Cent. will an Annuity of 250!. per Annum, payable Quarterly, to continue 6 Years, produce 1380l. 17s. 6d. for the present Worth.

When U, P, and R, are given, to find T.

THEOREM 16. First 
$$\frac{2}{r} \frac{2p}{u} = 1 = x$$
.

Then  $\sqrt{\frac{2p}{ur} + \frac{xx}{4}} \frac{x}{2} = t$ .

When the Payments are Half-Yearly or Quarterly, proted with the Annuity and Ratio as before directed, and he Quotient will be the Number of Payments.

#### EXAMPLES.

9. If 801. yearly Rent produces the present Worth of 4001. at 4 per Cent. what is the Time of its Continuance?

30. If an Annuity of 250l. per Annum produces 19
10s. 6d. for the present Worth at 3 per Cent. wha
the Time of its Continuance?

31. An Annuity of 2501. per Annum; payable Half-Yea is fold for 13761. 55. at 3 per Cent. I desire to ke the Number of Payments and Time to come?

32. Suppose a Lease of a House of 250l. per Annum, p able Quarterly, is fold for 1380l. 17s. 6d. at 3 Cent. I demand the Number of Payments and Ti to come?

ANNUITIES, &c. taken in REVERSION

#### CASE I.

To find the present Worth of an Annuity taken in version.

RULE.

- a. Find the present Worth of the yearly Sum at the given Rate, and for the Time of its Continuance.
- 2. Change P into A, and find what Principal being put to Interest will amount to A at the same Rate, and for the Time to come before the Annuity, &c. commences.

THEOREM 17.

I. Thus ttr-tr+2f :XU=

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z. Thus == P.

## EXAMPLES.

33. What is the present Worth of 2501. per Annum to c tinue 6 Years, but not to commence until the End of Years, allowing; per Cent. to the Purchaser? mark U=250, 1=6, and R=,03, then per Theorem 1.

$$\frac{108-,18+12}{,36+2}$$
 × 250= $\frac{.9+12}{2,36}$  × 250= $\frac{12,9}{23,6}$ : × 250=

4661016 × 250=1366,5254=P.

wper Rule 2. A=1366,5254, t=4, and r=,02,

m per Theorem 2. 
$$\frac{a}{tr+1} = \frac{1366,5254}{4\times,03+1} = \frac{1366,5254}{1,12}$$

6,112, or 12201. 25. 23d. the present Worth required.

What is the present Worth of a Lease of 80% per Annum, to continue 71 Years, but not to commence until the End of 5 Years, allowing 42 per Cent. to the Purto the Easer; I demand the yearly Rate ? chaser?

There is a Legacy of 401. per Annum, for 10 Years, left to a Person of 14 Years of Age; the Time of Payment is not to commence till the faid Person's Age be 21; but he wanting a Sum of Money, is minded to fell the fame at 5 per Cent. I demand the present Worth ?

When S. T. and R. are citemen. ofind the yearly Income of an Annuity, &c. in Rever-

#### RULE.

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and the Amount of the given Rate and for the Timeofits continuance hange A into P, and and what Annuity being fold will produce Pat the same Rate, and for the Time of its Continuance.

present Worth at the Thus Theorem 18. ptr+p=A

Thus 
$$\frac{tr+1}{ttr-tr+2t}:\times 2p=U$$

# EXAMPLES.

36. A Person having an Annuity left him for 6 Years and Months, but does not commence till the End of 4 Yea has disposed of it for the present Payment of 1220/. 23d. allowing 3 per Cent. to the Purchaser; what the yearly Income?

37. There is a Lease of a House taken for  $7\frac{1}{2}$  Years, I not to commence till the End of 5 Years, the Le would sell the same for 419l. 15s.  $1\frac{1}{4}d$ . present Payme allowing  $4\frac{1}{2}$  per Cent. to the Purchaser; what is

yearly Rent?

38. There is a Legacy of a certain Rate per Annum, for Years, left to a Person of 14 Years of Age; but Time of Payment is not to commence till the said fon's Age be 21 Years; but he wanting a Sum of I ney sold it for 2411. 191. 6.074d. allowing 5 per C to the Buyer; I demand the yearly Rate?

#### REBATE or DISCOUNT.

Here S represents the Sum to be discounted, P the pre Worth, T and R as before.

When S, T, and R, are given to find P.

THEOREM 19. 
$$\frac{1}{tr+1} = P$$
.

#### EXAMPLES.

39. What is the present Worth of 150% due 9 Months hat 5 per Cent?

Here 1=150, 1=,75, and R=,05; then per The

$$\frac{1}{4r+1} = \frac{150}{75+05+1} = \frac{150}{1,0375} = 144,5784 + \text{ or } 144^{1/2}$$

63d. the present Worth required.

40. What is the present Worth of 1000l. due at 5 M at 4½ per Cent?

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Leg:

What is the Discount of 93421. at 4 per Cent. for 10 Months?

When P, T, and R, are given, to find S. THEOREM 20. pir+p=S.

#### EXAMPLES.

Money due 9 Months hence, allowing 5 per Cent. for present Payment: I demand the Sum that was due at first?

hence, allowing 4½ per Cent. to be 981/. 105. 5d. what was the Sum first due?

A Person paid 91111. 35. 8½d for a Debt due to Months hence, he being allowed 4 per Cent. for the Dicount, how much was the Debt?

When S, P, and R, are given, to find T.

THEOREM 21. 
$$\frac{r-p}{pr} = T$$
.

#### EXAMPLES.

The present Worth of 150! due for a certain Time to come is 144!. 125. 6\frac{1}{4}d. at per Cent. I demand in what Time the first Sum should have been paid if no Rebate had been made?

A Person receives 9811. 105. 5d. for 10001. due at a certain Time to come, allowing  $4\frac{1}{2}$  per Cent. Discount, I desire ro know in what Time the Debt should have been discharged without any Rebate?

lhave received 91111. 31. 82d. for a Legacy of 93421. allowing the Executor 4 per Cent. I demand when the Legacy was payable without Rebate?

When S, P, and T, are given, to find R.

sh

The

## E'X A M P L E S.

At what Rate per Cent. will 150l. payable 9 Months hence, produce 144l. 11s. 63d. for the present Payment?

No

Th

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51.

52.

48. At what Rate per Cent. will 10001. payable at Months hence, produce 9811. 101. 5d. for the preh Payment?

49. At what Rate per Cent. will 93421. payable 10 Mon hence, produce 91111. 3s. 81d. for the present Paymen

## EQUATION of PAYMENTS.

To find the equated Time for the Payment of any Sum Money, due at several Times.

#### RULE.

of each Payment for its Thus THEOREM 23-

2. Add all the present Worths together, and call that S P, then will s-p=D, the Rebate.

3. And  $\frac{d}{pr}$ =E the true equated Time.

#### EXAMPLES.

50. A owes B 500/. to be paid as follows, viz. 100/. 8 Months, 150l. at 6 Months, and the rest at 9 Mont but they agree to have but one Payment of the Wh I demand the true equated Time, Rebate being m at 5 per Cent? Rebate had been made?

Here the first Payment = 200, 1=,25, and ==,05; the

the prefent Worth of rook for 3 Months.

The second Payment =150, =5,; and r, as before

Then 
$$\frac{3}{4r+1} = \frac{150}{5\times,05+1} = \frac{150}{1,025} = 146,34146$$
 the prefer

Worth of 150l. for 6 Months.

And the third Payment = 250, t=,75, and r, as bef

Then 
$$\frac{s}{r+1} = \frac{250}{.75 \times .05 + 1} = \frac{250}{1.0375} = 240.96385$$
 the pre-  
Worth of 250l. for 9 Months.

Worth of 250l. for 9 Months.

Now per Rule 2, 98,76344+146,34146+240,96385=486,06875=P. the present Worth of 500l. payable as above.

Then 5-2=500-486,06875=13,93125=D. the Rebate.

Also per Rule 3.  $\frac{D}{gr} = \frac{13.93125}{486.06875\times.05} = \frac{13.93125}{24.3034375} =$ 

573+ or, 5 Months, 26 Days, the equated Time required.

- 51. B owes C 1400% which was to have been paid as follows; 400% down, 500% at the End of 6 Months, 250 at the End of 8 Months, and the rest at the End of 10 Months; but they agree to have but one Payment of the whole Rebate at 3½ per Cent. the true equated Time is demanded ?
- 52. In what Time will the Interest of 491. 35. equal the Proceed of 191. 65. at Use 47 Days, at any Rate of Interest?
- 33. Put out 3841. to Interest, and in 84 Years there were 5421. 85. found to be due; what Rate of Interest could then be implied?

#### COMPOUND INTEREST.

The Letters made use of here, are,

A, the Amount.

P, the Primcipal.

T, the Time.

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R, the Amount of 11. for 1 Year, at any given Rate, which is found by the following Proportion.

Thus,

As \{ 100 : 105 : : 1 : 1,05 = R, at 5 per Cent. \\
100 : 106 : : 1 : 1,06 = R, at 6 per Cent, &c.

The Construction of the first Table following, shewing the Amount of 11. for any Number of Years under 31, at 3, 15, 4, 4, 1, and 5 per Cent.

Thus the Amount of 11. for 2 Years, at 5 per Ceut.

Compound Integers, will be 1,05×1,05=1,1025,

Alfo, 1,05×1,05×1,05=1,157625=the Amount of 11, 6 3 Years, at 5 per Cent. APPRIATE TOO

And the Construction of the second Table is by the conti nual Multiplication of the Amount of 11 for a Day the Amount of 1/. for a Day being the Root of its A mount for a Year, extracted to the 365th Power.

The Amount of 11. for a Day at 5 per Cent. is 1,001336 its Amount for 2 Days will be 1,00336x1,001336 1,0002672, &c. and 1,001336x1,001336x1,00133 =1,0004011, the Amount of 14 at 5 per Cent. for Days compound Interest.

the whole Reporte 1 37 of Cent. the left littlet Line Water and a fact of the second of the second of the Proceed of rol. be. at the 17 Days, of any Rose of Interest? the par out 384% to Intendi, and it it it livers there were

at the End of a first that each the me k of the last to More has subscribed a great to have but the controller of sold

call 8. founding be due a which are of lowest could builden ed nati

with the first state great the last COMPOUNT INTERLEST

tagus santa a santant di basa, Mebabi Aga The Letters made ale of here, are

A, the Amonata. P. the Mimorgal. diring Time.

R. the Address of all for a Vene or any given Rain, which is for a close Rain. The then zero and I among a some

A { 100 1 100 1 1 1 1 1 00 ± E. at c por cent.

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## TABLE I.

## The Amount of One Pound for Years.

Cars.	3 penCont.	3½ perCent	4 per Cent	42 perCent	5 per Cent.
1	1.0300000	1.0350000	1,0400000	1.0450000	1.0500000
2	1.0609000	1.0712250	1.08,6000	1.0920250	1.1025000
3	1.0927270	1.1087178	1.1248640	1.1411661	1.1576250
4	1.1255088	1.1475230	1.1698586	1.1925186	1.2155063
5	1.1592740	1.1876863	1.2166529	1.2461816	1.2762816
6	1.1948523	1.2292553	1.2653190	1.3022601	1-3400956
7	1,2298733	1.2722792	1.3159318	1.3608618	1.4071004
8	1.2667700	1.3168090	1.3685691	1.422 1006	1.4744554
9	1.3047731	1.3628973	1.4223118	1.4860251	1.5513282
10	1.3439163	1.4105987	1.4862443	1.5529694	1.6288946
11	1,3842338	1.4599697	1.5394541	1.6228530	1.7103393
12	1,42 57608	1,5110686	1.6010322	1.6958814	1.7958563
13	1,4685337	1.5639560	1.6650735	1.7721961	1.8856491
4	1,5125897	1.6186045	1.7316764	1.8519449	1.9799316
15	1.5579674	1.6753488	1.8009435	1.9352834	2.0789282
16	1.6017064	1.7339860	1.8729812	2.0223701	2.1828746
17	1,6528476	1.7946755	1.9479005	2.1133768	2.2920183
18	1,7024330	1.8574892	2.0258165	2.2308478	2.4066192
19	1.7535060	1.9225013	2.1068492	2.3078603	2. 5269502
20	1,8061112	1.9897888	2.1911231	2.4117140	2.6532977
11	1.8602945	2.0594314	2.2787681	2.5202411	2.7859626
12	1.9161034	2.1315115	2.3699188	2.6336520	2 92 52607
23	1.9735865	2.2061344	2-4647155	2.7921663	3.0715238
24	2,0327941	2.2833284	2.5633042	2.8760138	3.2251000
25	2.0937779	2.3632449	2.6658363	3.0054344	3.3863549
26	2.1565912	2-4459585	2.7724697	3.1406709	3.5546727
27	2 22 12890	2.5315671	2.8833685	3 2820095	3-7334563
28	2.2879276	2.6201719	2.9987033	3 4296999	3.9201291
29	2.3565655	2.7118779	3.1186514	3-5840364	4.1161356
30	2.4272624	2.8067937	3-2433975	3.7453181	4.3219424

BL

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## TABLE A

## .The Amount of One Pound for Days.

Days.	3 per Cent.	3½ perCent	4 per Cent.	4½ perCent	5 per Cen
and decide	1.0000809	1.0000942	1.0001074	1.0001206	1.000133
2	1.0001619	1.0001885	1 0002149	1.0002412	1.000297
3	1 0002429	1 obc 2827	1 0003224	1.0003618	1.000401
654	1.0003240	1.0003770	1.0004299	T.0004824	1.000534
5	1.0004050	1.0004713	1.0005374	1.0006031	1.00066
6	1.0004860	1.0005656	1.0006449	1.0007238	1.00080
7	1.0005670	1.0006600	1.0007524	1.0008445	1.00093
7 8	1.0006480	1.0007542	1.0008600	1.0009652	1.00106
9	1.0007291	1.0008486	1.0009675	1.0010859	1.00120
10	1.0008101	1.0009429	1.0010751	1.0012066	1.00133
20	1.0016209	1.0018867	1.0021512	1.0024148	1.00267
30	1.0024324	1.0028315	1.0032288	1.0036243	1,00401
40	1.0032445	1.0037771	1:0043074	March 1964 Co. C. March 1964 Co. C.	1.00536
50	1.0040573	1.0047236	1.0053871	1.0060479	1.00670
60	1.0048708	1.0056710	1.0064680		
70	1.0056849	1.0066193	1.0075501	1.0084773	1.00940
80	1.0064996	1 0075685	1.0086333	1.0096942	1.01075
-90	1.0073151	1.0085186	1.0097177		1.01210
100	1.0081311	1.0094696		1.0121324	1.01345
110	1.0089479	1.0104214	1.0118900		1.01481
120	1.0097653	1 0113742			1.01616
130	1,0105834	1.0123279			1.01752
140	1.0114021	1.0132825	1.0151572		1.01889
150	1.0122215	1.0142379	1.0162487	1.0182537	
160	1.0130415	1.0151943	1.0173412	1.0194824	
170	1.0138623	1.0161516	11.0184350	1.0207126	
180	1.0146837	1.0171098			1.02435
190	1.0155057	1.0180689			1.02572
200	1.0163284	1.0190288	1.0217233		
210	1.0171518	1.0199897	1.0228218	1.0256481	
220	1.0179759	1.0209315	1.0239215	1.0268858	1.02984
230	1.0188006	1.0219142	1.0250223	1.0281249	1.03121
240	1.0196260	1,0228778		1.0293655	1.0320
250	A STATE OF THE PARTY OF THE PARTY OF THE PARTY.				1.0339

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# When P, T, and R are given, to find A.

# THEOREM I, pxr=A.

If By the foregoing Tables, thus, Multiply the Principal by the tabular Number for the given Time and Rate, and

he Product will be the Amount required.

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If the Amount is required for any Number of Years or Days that are not in the Tables, then observe this Rule. Divide the given Number of Years or Days into such Numbers as are in the Tables, then multiply the Amounts nowering to each, into each other, continually; and the Present by the Principal, which will be the Amount required.

### EXAMPLES.

What will 2001. amount to in 4 Years, at 5 per Cent. per Annum?

Here P=200, t=4, and r=1.05, then per Theorems  $1 \times r^2 = 200 \times 1.05 \times 1.05 \times 1.05 \times 1.05 = 200 \times 1.2155063 = 243,10126$ , or 243t. 21. 4t. the Amount required.

By the Table, thus,

Table I. against 4 Years, under 5 per Cent. is 1,2155063

Thich, multiplied by the Principal, 200

he Product is the Amount as before, viz. 243,101261.

Or, Suppose the Amount of the above Sum was required for 40 Days, then,

Table II. against 40 Days, under g per

Cent. is r,00053612

he Product is the Amount, viz. 200,107222=

2001. 2s. 1\$d. nearly.

What will 2461. 101. amount to in 7 Years, at 5 per Cent. per Annum?

3. What

DON

TAIL IV

3. What will 500/. amount to in 30 Years or Days, at 412 Cent.?

4. What is the Amount of 523% in 5 Years, and 194Da at 5 per Cent.?

# When A. R. and T. are given, to find P.

# THEOREM 2. $\frac{A}{R}t=P$ .

2. By the foregoing Tables, thus, Divide the Amount the tabular Number for the given Time and Rate, and Quotient will be the Principal required.

5. What Principal, or Sum of Money, must be put ou raise a Stock of 2431. 25. 4d. in 4 Years, at 5 per Coper Annum?

6. What Principal, being put to Interest, will amount 3461. 175. in 7 Years, at 5 per Cent. per Annum?

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7. What Principal, being put to Interest for 30 Years 42 per Cent. per Ann. will amount to 18721. 131.2

8. What Principal, being put to Interest for 5 Years and Days, will amount to 6851. 72d. at 5 per Cent. per A

# When P, A, and R are given, to find T.

THEOREM 3. ==R. Swhich being continually divided by till nothing fremains, Number of those Divisions will equal to T. the Time.

3. By the foregoing Tables, thus, Divide the Amount of the Principal, and the Quotient will be the Amount of the given Rate, which will be found under the Rate with the Time required.

#### Essention E. X. A .M . RugLA En S. foctor

9. In what Time will 2001. raise a Stock of (or amount 2431. 2s. \frac{1}{2}d. allowing 5 per Cent. per Annum?

10. In what Time will 2461. 10s. amount to \frac{3}{2}61. 171.

per Cent. per Annum?

In what Time will 500l. amount to 1872l. 13s. 2d. at 4½ per Cent. per Annum?

In what Time will 523l. amount to 685l. 7½d. at 5 per Cent. per Annum?

When A, P, and T are given, to find R.

which being extracted by the Rules of Extraction (the Time given to the Question shewing the Power) will give the Rate.

By the foregoing Tables, thus, proceed as with the last, even with the given Time is under the Rate required.

### EXAMPLES.

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At what Rate per Cent. per Annum, will 2001. become 2431. 25. ½d. in 4 Years?

At what Rate per Cent. will 2461. 105. amount to 3461. 175. in 7 Years?

At what Rate per Cent. will 5001. amount to 18721. 135. 2d. in 30 Years?

At what Rate will 5231. amount to 6851. 7½d. in 5 Years and 194 Days?

# ANNUITIES, PENSIONS in ARREARS.

tre U represents the Annuity, Pension, or yearly Rent, and T, as before.

le 3d Table shews the Amount of 1l. Annuity for any ber of Years under 31, at 3, 3\frac{1}{2}, 4, 4\frac{1}{2}, and 5 per Cent.

In thus constructed: Take the first Year's Amount, which multiply it by 1,05+1=2,05=2d Year's Amount, halfo multiply by 1,05+1=3,152=3d Year's Amount.

The 4th Table shews the present Worth of 1l. due at any ber of Years, to commence under 31, Rebate at 3, 3\frac{1}{2}, and 5 per Cent. And is made thus 1\frac{1}{2},05=,952381

Year's present Worth, and .952381\frac{1}{2},05,=9070,295

Year's, and .90703\frac{1}{2},05=,8638376, the third Year's at Worth, &c.

TABLE

Il per Cent. per Account

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# TABLE III.

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The Amount of one Pound per Annum, or Annuity for Years.

Years.	3 per Cent.	3½ per Cent.	4 per Cent.	4½ per Cent.	5 per Cent
1	1.0000000	1.0000000	1.0000000	1:0000000	1.0000000
2	2.0300000	2.0350000	2.0400000	2.0450000	2.0500000
3	3.0909000	3.1062250	3.1216000	3.1370250	3.1525000
4	4.1836270	4-2149419	4.2464640	4.2781911	
0.010350	5.3091358		5-4707097	5.4707097	5.525631
5	6,4684099		6.6329755		
7	7.6624622	7-7794075	7.8982943	7,0191518	8.742008
8	8.8923360	9.0516866	9.2142263	9.3800136	9-549364
9	10.1591061	10.3684958	10.5827953	10.8021142	11.026787
10	11.4638793	11.7313931	12.0261071	12.2882094	12 577192
T1	12.8077957	13.1419919	13.4863514	13.8411788	14.206787
12	14.1920296	14.6019616	15.0258055	15.4640319	15.917126
13	15.6177904	16.1130303	16.6262397	17.1599133	17.712982
14	17.0863242	17.6769864	18.2919112	18.9321094	19.598032
15	18.5989139	19.2956809	20.0235876	20.7840543	21.578503
16	20.1568813	20.9710297	21.8245311	22.7193367	23.657491
17	21.7615877	22.7050158	23.6975124	24.7417009	25.840300
18	23.4144354	24.4996912	25.6454129	26.8550837	28.132384
19	25.1168684	26.3571805	27.6712294	29.0035625	30.539003
20	26.8703745	28.2796818	29.7780786	31.3714220	33.005954
21	28.6764857	30.2694707	31.9692017	33.7831308	35.71925
2-	30.5307803	32.3289022	34.2479698	30.5033779	38.505214
23	32 4528837	34-4604137	36,6178886	38.9370299	41.430409
24	34.4264702	36.6665282	39.0826041	41.0891903	44 501990
25	130.4592043	30.9498507	141.0459003	44.5052101	47.12/090
26	38.5530422	41.3131017	44-311744(	47.5700440	51.113453
27	40.7096235	47.7590002	147.0842144	150-7113230	54.009124
28	42.9309225	40.2906277	49.9675830	153.9933333	58.402594
29	45.2188502	48.9107993	52.9602863	57.4230332	02.32271
30	47-5754157	51.6226773	150.0849377	01.0070007	100.430047

# TABLE IV.

# The present Worth of One Pound for Ye rs.

3 per Cent.	3½ per Cent.	4 per Cent.	41 per Cent.	5 per Cent.
.9708738	.9651836	.9615385	-9569378	.9523809
.9425959	.9331507	.9245562	.9157299	9070295
.9151417	.9019427	.8880964	.8762966	.8628376
.8884870	.8714422	.8548042	.8385613	.8227025
.8626088	.8419732	.8219271	.8024511	17835262
.8374843	,8135006	.7903145	76,8957	.7462154
.8130915	.7859910	.7599178	-7348285	.7106813
.7804092	.7594116	.7306902	.7031851	.6768394
.7664167	-7337310	.7025867	.6729044	.6446089
.7440939	.7089188	.6755642	-6439277	.6139133
.7224213	.6849457	.6495809	.6161988	.5846703
.7013799	.6617833	.6245971	. 5896639	.5568374
.6809513	.6394941	.6005741	.5642716	.5303214
4 .6611178	.6177818	-5774751	1 -5399729	.5050679
6418619	.5968506	-5552645	1.5167204	.4810171
.6231669.	.5767059	1.5339082	4944693	.4581115
1 .6050164	.5572038	.5133733	1.4731764	.4362967
.5873946	.5383611	4936281	.4528004	4155207
.5702860	.5201557	4746424	4333018	-3957349
.5536758	.5025659	4563870	4146429	-3768895
-5375493	.4855709.	.4388336	,3967874	-3489424
1 .5216925	.4691506	4219554	.3797009	1.3418479
3 :506( 917	4532856	1-4057263	1.3633501	3255713
4919337	-4379571	.3901215	1 .3477035	.3100639
4776056	-4231470	.3751168	1.3327306	.2953028
4636047	.40883-8	.3606802	.3184025	.2812407
4501891	.3950123	.3468166	-3046914	.2678483
4370768	-3816543	-3334775	.2915707	.2550936
4243464	.3687482	.3206514	.2790150	.2429463
4119' 68	1.3562784	1 .3083187	1.2670000	.2315775

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When U, T, and R, are given, to find A.

THEOREM 5. 
$$\frac{Ur^t-u}{r-1}=A.$$

By Table III, thus, Multiply the Annuity by the Tabu Number for the given Time and Rate, and the Product w be the Amount required.

# EXAMPLES.

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I. What will an Annuity of 701. per Annum (payable ye ly) amount to in 4 Years, allowing 4 per Cent. per An

Here 
$$U=70$$
,  $t=4$ , and  $r=1,04$ , then per Theore  $\frac{urt-U}{r-1} = \frac{70\times1,04\times1,04\times1,04\times1,04-70}{1,04-1} =$ 

=297,25255, or 2971. 55. 02d. the Amount requi

## By Table III. thus,

Against 4 Years, and under 4 per Cent. is — 4,246
Which multiply by the Annuity — —

The Product is the present Worth, as before, L. 297,25

2. If a Salary of 1001. per Annum, to be paid yearly, be borne 6 Years, or unpaid, at 5 per Cent. per Ann. is the Amount?

3. A Minor of 14 had an Annuity left him of 701. a left the Proceed of which, by Will, was to be put out, Principal and Interest, yearly, as it fell due, at 3 Cent. till he should attain to 21 Years of Age; the most Improvement being made of this Part of his tune, what had he then to receive?

4. If an Annuity of 30/. per Aunum, payable yearl, omitted to be paid for 30 Years, at 32 per Cent.

is the Amount?

When A, T, and R are given, to find U.

THEOREM 6.  $\frac{ar-a}{r^{t-1}} = U$ .

By Table III. thus, Divide the Amount given by the Taplar Number for the given Time and Rate, and the Quoient will be the Annuity required.

EXAMPLES.

What Annuity, forborne 4 Years, will amount to 2971.

What Pension, being forborn 6 Years, at 5 per Cent. will amount to 6801. 3s. 911. 6288?

What Annuity will amount to 5361. 7s. 52d. 45984 in 7 Years, at 3 per Cent?

If the Payment of an Annuity be forborne 30 Years amount to 15481, 135. 71d. at 31 per Cent.?

When U, A, and R, are given, to find T.

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HEOREM 7.  $\frac{ar+u-a}{u}$  = Rt. { Proceed with as in Theorem 3, which will give T the Time.

By Table III. thus, Divide the Amount by the Annuity, at the Quotient will be the Amount of 1L at the given ate, which will be found under the faid Rate even with the interequired.

EXAMPLES.

In what Time will 701. per Annum amount to 2971. 51.

h In what Time will a Salary of 100% per Annum amount to 680%. 35. 93d. at 5 per Cent.?

I ln what Time will an Annuity of 70l. amount to 536l.

In what Time will 301. per Annum amount to 15481.

When A, U, and T are given, to find R.

THEOREM 8.  $\frac{ar}{u} - r^t = \frac{a-u}{u} = R^t$ 

This being a very high Equation, it requires the Assist-

By By

By Table III. thus, Proceed as in the last Rule, which give the Annuity which 11. will purchase for the given Tin which will stand even with the said Time, and under Rate required.

# EXAMPLES.

- 13. At what Rate per Cent. per Annum will an Annuity 70l. per Annum amount to 297l. 55. ½d. 448 in Years?
- 14. At what Rate per Cent. per Annum will a Salar 100l. per Annum amount to 686l. 3s. 94d. 628 6 Years?
- 15. At what Rate per Cent. per Annum will an Annuit 70%. per Ann. amount to 536%. 75. 544. 45984in 7 Yea
- 16. At what Rate per Cent. per Annum will a Salary of per Ann. ammount to 1548/. 135. 74d. 0264 in 30 Ye

## PRESENT WORTH of ANNUITIES, &c.

The 5th Table shews the present Worth of 1l. Annuit any Number of Years under 31, at 3, 3½, 4, 4½, and 5 Cent. and is made thus, Divide 11 by 1,05=,95238, present Worth for the first Year, which: 1,05=,90703 at to the first Year's present Worth, =1,85941, the se Year's present Worth again ,90703—1,05 and Quo added to 1,85941=2,72324=third Year's present W&c.

The 6th Table shews the Annuity which 1l. will pur for any Number of Years under 31, at 3, 3½, 4, 4½, and Cent. and is constructed by finding the present Worth oper Annum in the 5th Table, at the assigned Rate and I and dividing Unity or 1 thereby, the Quotient will be Annuity, that 1l. will purchase at the same Rate for the Time.

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# T A B L E V.

The present Worth of One Pound per Annum, or Annuity for Years.

Years.	3 per Cent.	3½ per Cent.	4 per Cent.	41 per Cent.	5 per Cent.
1	0 9798738	c 9661836	0.9615385	0.9569378	0.9523809
2	1.9134697	1.8996943	1.8860947	1.8726678	1.8594104
3	2.8286114	2 8016370	2.7750910	2.74 9644	2 7232480
4	3.7170984	3.6730792	3.6298952	3 5875257	3.5459505
5	4-5797072	4.5150524	4 4518223	4 3899767	4.3294767
6	5.4171914	5.3285530	5 2421369	5.1578725	5.0756921
7	6 2302829	6.1145439	6 0020547	5.8927009	5.7863734
8	7.0196922	6.8739555	6.7327448	6.5958861	6.4632128
9	7.7861039	7.6076865	7 4353314	7.2687905	7.1078217
10	8.5302028	8.3169053	8.1108955	7 9127182	7.7217349
11	9 5256241	9.0015510	8.7604763	8.5289169	8.3064142
12	9 9540040	9.6633343	9.3850733	9.1185808	8.8632516
13	10.6349553	10.3027585	9.9856473	9.6828524	
14	11.2960734	10.9205203	10.5631224	10.2228253	9.8986409
15	7.7 733	11.5174109	11.1183868	10.7395457	10.3796580
10	12.5611020	12 0941168	11.6522949	11.2340151	10.8377695
17	13.1661185	12.6513206	12.1656680	11.7071914	11.2740622
18	13.7535131	13.1896817.	12.6592961	12.1599918	11.689 5869
19	14.3237991	13 7098374	13.1339385	12.5932936	12 0853208
20	14.8774748	14.2124033	13.5903253	13.0079365	12.4622103
21	15.4150241	14 6979742	14 0291589	13.4047239	12.8211527
22	15.9369 166	15.1671248	14.451.1142	13.7844248	13.1630026
23	16.4436084	15.6204105	14.8568405	14.1477749	13.4885739
24	16 9355421	16.0583676	15.2469619	14.4954784	13.7986418
25	17.4131477	the state of the state of the state of the state of	15.6220787	14.8282089	14.0939445
26	17.8768420	The second second second second second	15.9827678	15.1466115	14.3751853
27	18.3270315		16.3295844	15 4513028	14.6430336
28	1	17.6670188	16 6630618	15.7428735	14.8981272
1	19.1884546		16.9837132	16 0218885	15.1410735
15	1.19.6004413	18 3920454	17.2920318	16.2888285	15.37245 0

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# TABLE VI.

When I, R, and T are given

The Annuity which One Pound will purchase for any Number of Years,

Years,	3 per Cent.	3½ perCent	4 per Cent.	4½ perCent	5 per Cent.
1	1.0300000	1.0350000	1.0400000	1.0450000	1.0500000
2	.5226108	.5264005	.5301961	.5339976	-5378049
3	-3535304	.3569342	.3603485	-3637734	.3672086
4	.2690271	.2722511	.2754901	.2785437	.2820118
	.2183546	.2214814	.2246271	.2277916	.2309748
5	.1845975	.1876682	.1907619	.1938784	.1970175
7	.1605064	.1635445	.1666096	.1697015	.1728198
7 8	.1424564	.1454767	.1485279	.1516097	.1547218
9	.1284339	.3314460	.1344930	-1375745	.1406901
10	.1172305	.1202414	.1232909	.1263788	.1295046
11	.1080775	.1110920	.1141490	.1172482	.1203889
12	.1004621	.1034840	.1065522	.1096662	.1128254
13	.0940295	.0970616	.1001437	.1032754	.1064558
14	.0885263	.0915707	.0646690	.0978203	.1010240
15	.0837666	.0868251	-0899411	.0931138	.0963423
16	.0796109	.0826848	.0858200	.0890154	.0922699
17	.0759525	.0790431	.0821985	.0854176	.0886991
18	.0727087	.0758168	.0789933	.0822369	.0855462
19	.0698139	.0729403	.0791386	-0794073	.0827450
20	.0672157	.0703611	.0735818	.0768761	.0802426
2.1	.0648718	.0680366	.0712801	.0746006	.0779961
22	.0627474	.0659321	.0691988	.0725457	.0759705
23	.0608139	.0640188	.0673091	.0706825	.0741368
24	.0590474	.0622728	.0655868	.0689870	.0724709
25	.0574279	.0606740	.0640120	.0674390	.0709525
26	.0559383	.0592054	.0625674	.0660214	.0695643
27	.0545642	.0578524	.0612385	.0647195	.0682919
28	.0532932	.0566029	.0600130	.0635208	.0671225
29	.0521147	.0554454	.0588799	.0624146	.0660455
10	.0510193	.0543713	.0578301		.0650614

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When U, R, and T are given, to find P.

THEOREM 9. 
$$u - \frac{u}{r^t} : -r - 1 = P$$
.

By Table V. thus, Multiply the Tabular Number for the iven Time and Rate, by the Annuity, &c. the Product will the present Worth required.

#### EXAMPLES.

What is the present Worth of an Annuity of 501. per Annum, to continue 8 Years at 5 per Cent?

Mre U=50, 1=8, and R=1,05, which being involved to

fire U=50, t=8, and R=1,05, which being involved to Ri=1,4774554 by the 1st Table, then per Theorem

$$\frac{50}{1,477454} \cdot 1,05 - 1 = 50 - 33,84196$$

605=16,15804,05323,1608, or 3231. 35. 214. 368, or by the Table, thus,

winst 8 Years and under, 5 per Cent. is - 6,4632128 hich multiplied by the Annuity, \_\_\_\_\_\_

ites the present Worth as before, viz. £. 323,1606400

What is the present Worth of an Annuity or yearly Rent of 601. to continue 6 Years at 4 per Cent?

What is the present Worth of a Pension of 10001. per Annum, for 21 Years, at 4½ per Cent?

When P, T, and R are given, to find U.

THEOREM 10. 
$$\frac{pr^t \times r - pr^t}{rt - 1} = U$$
.

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Whe

Table V. thus, Divide the present Worth by the TaNumber for the given Time and Rate, and the Quotwill he the Annuity required.

hy Table VI. thus, Multiply the Tabular Number (for given Rate and Time) by the present Worth, and the suff will be the Annuity.

#### EXAMPLES.

the present Worth of 3231. 35. 21d. 368 were required for a Pension for 8 Years to come, at 5 per Cent. what was the Pension?

5. What

5. What Annuity or yearly Rent may be purchased so 3141. 10s. 63d. 08544 at 4 per Cent for 6 Years?

6. Suppose the present Worth of a Pension for 21 Year at 4½ per Cent. was 134041. 14s. 52d. 944 what was 1 Pension?

When U, P, and R are given, to find T.

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THEOREM 11. 
$$\frac{u}{p+u-pr} = R'$$
. { Which proceed with as in Theorem 3, will give T.

By Table V. thus, Divide the present Worth by the A nuity, and the Quotient will be the Amount of 1l. at t given Rate, which will be found under the said Rate, ev with the Time required.

#### EXAMPLES.

6. How long may one have a Lease of 501. yearly Rent 3231. 35. 22d. 368, allowing 5 per Cent to the Perchaser?

7. If an Annuity of 60% is purchased for 3141. 101. 6 08544, at 4 per Cent. what Time ought it to continu

8. I demand what Time a Lease of 1000l. may be purcha for, when the present Worth of 13404l. 141. 54d. made at 4½ per Cent?

When U, P, and T are given, to find R.

THEOREM 12. 
$$\frac{u}{p} = \frac{u}{p}R^t + R^t - R^t + 1.$$

This being a very high Equation, requires the Affistance Algebra to determine R.

By Table V. proceed as in the last Rule, and the Quoti will be the Amount of 11. Annuity for the given Time, o which will be the Rate required.

#### EXAMPLES.

9. If an Annuity of 50l. to continue for 8 Years, be a chased for 323l. 3s. 2½d. 368, what Rate of Interest has the Purchaser for his Money?

60l. to continue 6 Years, at what Rate was Interest

lowed?

11. If an Annuity of 1000l. to continue 21 Years be purchased for 134041. 141. 51d 944 what Rate of Interest is the Purchaser allowed for his Money?

ANNUITIES, LEASES, &c. taken in REVERSION.

To find the present Worth of Annuities, &c. in Reversion.

#### RULE.

Find the present Worth of the Annuity, &c. at the given Rate, and for the Time of its Continuance, U-r:+r-1=P

by Theorem 9.

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thange P into A, and find what Principal being put to Interest will amount to P at the same Rate and Time to come before the Annuity | Thus =P. commences, by Theorem 2. which will give the present Worth of the Annuity.

By Table V. thus, Find the present Value of 11. per Annum, at the given Rate, both for the Time being, and also for that and the Time in Reversion added together, then hbtract the Time in being from the other, and multiply the Remainder by the Annuity, the Product will be the preent Worth required.

## XAMPLE

I. What is the present Worth of a Reversion of a Lease of 801. per Annum, to continue 6 Years, but not to commence till the End of 2 Years, allowing 5 per Cent. to the Purchaser?

1. Here u=80, t=6, and r=1,05, then per Rule 1.

$$\frac{u}{r-1} = 80 - \frac{80}{1,3400955} = 1,05 - 1 = 80 - 59,6976$$

:,05=20,3028:,05=406,056=P. Then per Rule 2.

h=406,056, t=2, and r, as before, and per Theorem 2,

 $\frac{a}{406,056}$  = 368,30419, or 3681. 6s. 1d. the present 1 41,1025

Worth required.

Thus, by the Table, 2+6=8 Years.

Then {6,4632128=Value of 11. for 8 Years. 1,8594104=ditto, for 2 Years.

Remains 4,6030024 Which × 80 Annuity

Gives £. 368 304192 as before.

2. What ought a Person to give down in ready Money so the Reversion of 1000% a Year, to continue 20 Year on a Lease which cannot commence till 5 Years are a an End, allowing the Purchaser 5 per Cent?

To find the yearly Income of an Annuity taken in Reve fion.

#### RULE.

1. Find the Amount of the present Worth at the given Rate, and for the Time before the Annuity commences, by Theo. 1.

2. Change A into P, and find what yearly Rent, &c. being fold, will produce P at the fame Rate, and for the Time of its Continuance, by Theo. 10.

Thus, pri=A.

Thus,  $\frac{prt \times r - prt}{r^t - 1} = U$ 

By Table V. thus, proceed as in the last Rule, and divi the present Worth by the Remainder, the Quotient will the Annuity required.

# EXAMPLES

3. What Annuity, to be entered upon two Years here and then to continue 6 Years, may be purchased 1 3681. 6s. 1d. ready Money, allowing 5 per Cent. to 1 Purchaser?

4. Suppose the present Worth of a Lease of an Estate
81321. 145. 8a. 061, taken in Reversion for 20 Yea
but not to commence till the End of 5 Years, allow
5 per Cent. to the Purchaser; what is the yearly Ren

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#### 68. REBATE or DISCOUNT.

Here S represents the Sum to be purchased. When S, T, and R are given, to find P.

THEOREM 13.  $\frac{s}{rt} = P$ .

By the 4th Table, thus, Multiply the Tabular Number for the given Time and Rate, by the Sum to be purchased, the Product will be the present Worth.

#### EXAMPLES.

What is the present Worth of 150.1. payable 4 Years hence, at 5 per Cent?

Here  $\frac{s}{rt} = \frac{150}{1,2155063} = 123,40536$ , or 1231. 8s. 14d. present Worth required.

the Table, thus, ,8227025×150=123,405375 as be-

What is the present Worth of 7431. 4s. 9d. payable 6 Years hence at 4 per Cent?

When P, T, and R are given, to find S.

THEOREM 14. pxr1=S.

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By Table IV. thus, Divide the present Worth by the Tawlar Number for the given Time and Rate, and the Quoient will be the Sum to be purchased.

# EXAMPLES.

If 1231. 8s. 14d. be received for a Debt payable 4 Years hence, and an Allowance of 5 per Cent. to the Debtor for present Payment, what was the Debt?

If a Sum of Money due 6 Years hence produces 5871. 7s. 94d.718, for present Payment, Rebate being made at 4 per Cent. I demand how much the Debt was?

When S, P, and R are given, to find T.  $T_{\text{HEOREM 15}} = \frac{s}{p} = r^t \begin{cases} \text{which proceed with as in Theorem 3.} \end{cases}$ 

By Table IV. thus, Divide the Principal by the Sum to be purchased, and the Quotient will be the present Worth of 1/2 at the given Rate, which will be found under the Rate, and even with the Time required.

#### EXAMPLES.

6. A Person received 1231.81. 14d. for a Debt of 1501. Re bate being made at 5 per Cent. I demand in what Time the Debt was payable?

7. The present Payment of 5871. 75. 92d. 718, is made for Debt of 7431. 45. 9d. Rebate at 4 per Cent. I deman

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when the Debt was payable?

When S, P, and T are given, to find R.

THEOREM 16.  $\frac{S}{p} = R'$  Which proceed with as in Theorem 4.

By Table IV. thus, proceed as in the last Rule, and the Quotient will be the present Worth of 1% for the give Time, which will be found even with the Time, and under the Rate required.

#### EXAMPLES.

8. The present Worth of 150l. payable 4 Years hence, 123l. 8s. 17d. at what Rate per Cent. is the Reba made at?

9. The Sum of 7431. 4s. 9d. is payable in 6 Years Tim and the present Value of that Sum is 5871. 7s. 9\frac{3}{4}d.71 I demand at what Rate per Cent. the Rebate must made?

### PURCHASING Freehold or Real ESTATES,

Is to find the present Worth of an Annuity, &c. to co

When U and R are given, to find P.

THEOREM 17. 
$$\frac{u}{r-1} = P$$
.

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### EXAMPLES.

Suppose a Freehold Estate of 500%. per Annum were to be sold; what is the Worth, allowing 5 per Cent. to the Buyer?

he u=500, r=1,05; then per Theorem

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$$\frac{4}{1-1} = \frac{500}{1,05-1} = \frac{500}{10000}$$
 10000l. the prefent Worth?

What is an Estate of 251. per Annum, to continue for ever, worth in present Money, allowing 4½ per Cent. to the Buyer?

When P and U are given, to find R.

THEOREM 18. 
$$\frac{P+u}{p}=R$$
.

### EXAMPLES.

Suppose one gave 1000l. for a Freehold Estate of 500l. per Annum, what Rate per Cent. has the Purchaser for his Money?

fan Estate of 251. per Annum is bought for 5551. 115.

When P and R are given, to find U.

THEOREM 19. PXr-1=U.

# EXAMPLES.

Suppose a Person would lay out 10000. On a Freehold Estate, and so as to be allowed 5 per Cent. for his Money, what must be the annual Rent of such an Estate?

If a Freehold Estate is bought for 5551: 115. 14d. and the Allowance of 4½ per Cent. is made the Buyer; what is the yearly Rent?

69 Purchasing FREEHOLD ESTATES in REVERSIO

To find the Worth of a Freehold Estate in Reversion.

#### RULE.

1. Find the Worth of the yearly Rent, &c.

2. Change P into A, and find what Principal being put to Interest will amount to A, at the same Rate, and for the Time to come before the E-state commences.

Theo. 20, Thus  $\frac{u}{r-1}$ 

Thus  $\frac{A}{R}t = P$ .

#### EXAMPLE.

Money, to continue for ever, but not to comme till the End of 4 Years, allowing 5 per Cent. to Purchaser?

To find the yearly Rent of an Estate taken in Reversion

#### R U L E.

of the Estate at the given
Rate, and Time before it
commences.

2. Change A into P, and find what yearly Rent being fold will produce P at the fame Rate.

Theo. 21. pxrt=1

d

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P An th

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A S

 $Pr \times r - pr = U$ 

#### EXAMPLE.

3. A Freehold Estate is fold for 82271. 1s. 4d. which not commence till the End of 4 Years, the Buyer's allowed 5 per Cent. for his Money: I defire to the yearly Income?

QUESTIC

# QUESTIONS for EXERCISE.

Held of a College 4861. 10s. a Year, on a referved Rent of 941. Money being at 5 per Cent. Interest; what Fine ought severally to be paid on a 7, a 14, and a 21 Year's Lease?

Years to come, the improved Rent being 1861. 75. 6d. per Annum; what ought I to pay down in ready Mo-

ney for this Favour, discounting 4 per Cent?

A has a Term of 7 Years in an Estate of 501. per Annum; B hath a Term of 14 Years in the same Estate; and C hath a farther Term of 10 Years after B in the same Estate: what is the present Value of the several Interests in the said Estate?

For a Lease of certain Profits for 7 Years, A offers to pay 150l. Gratuity, and 300l. per Annum; B offers 400l. Gratuity, and 250l. per Annum; C bids 650l. Gratuity, and 200l. per Annum; and D offers 1800l. for the whole Purchase, without any yearly Rent: Query, which is the best Offer, and what Difference, computing at 4 per Cent.?

Value the Lease of a House in tolerable Repair, the Rent 541. 175. a Year, the Ground Rent 7 Guineas, 3 Years of it only to come, the Rent payable every 6 Months, Discount per Compound Interest on this Kind of Pur-

chase, at 101. per Cent.?

A Fine for a Lease of a Tenement is settled at 1531. under a reserved Rent of 161. a Year: Now the Tenant cannot conveniently pay more than 501. but for the 6 Years to come of the Term, is willing rather to pay an adequate Rent, computing 101. per Cent. per Compound Interest; what ought that Rent to be?

Another Lease for 7 Years is agreed for at 2501. Fine, on the old Rent 441. a Year; but confidering the Contractor desires to reduce the Rent to 201. a Year, and pay a proper Fine, computing, as before, after the Rate of 101. a Year; to what must the Fine be ad-

vanced?

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A Son, previous to his Marriage, is minded to have 501.

a Year Freehold fettled on his Family, and to have immediate

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mediate Possession of it, offers his Father in Lieu a Annuity for his Life, valued at 12 Years Purchase Discounting at 4 per Cent. thereon; whereas he is content the Estate should be valued at a Discount of 3 per Cent. and consequently will be worth 33 3 Years Purchase: pray what had the Father for his Life?

9. A Gentleman took a College Lease of 2371. a Year, so 21 Years, and paid the full Fine; the Rent reserve was 101. a Year, but when 4 Years were elapsed, gainst the Marriage he renewed the Lease, and filled the 21 Years. In 14 Years after that his Wife dyin he again renewed it in Favour of his Daughter, then Years of Age; and by the Time she was 19, it was third Time renewed in order to her Settlement: To Question is, what Money the Society must have received from this Family from first to last, allowing 51.

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# TUTOR'S GUIDE.

#### PART IV.

# MENSURATION.

#### GEOMETRICAL DEFINITIONS.

GEOMETRY contains the Nature and Properties of Lines, Angles, Surfaces and Solids.

A Point is that which has no Parts or Magnitude.

ALine is Length conceived without Breadth.

An Angle is the mutual Inclination of two Lines which neet.

When a strait Line, as CD, (Fig. 4.) standing upon another, AB, makes the Angles, ADC, and CDE, on each side equal to one another, each of these equal Angles is calcularight Angle, and the dotted Line CD, is said to be perendicular to the Line AB.

An Angle is commonly expressed by three Letters, that atted at the angular Point being always wrote in the Mide, as A D C, (Fig. 4.) denotes the Angle, b.

An obtuse Angle is that which is greater than a right An-

An acute Angle is that which is less than a right Angle, DCB, (Fig. 4.)

Z 3

Paral-

Parallel Lines are those of which every Point of the one is at the same Distance from the other, as the Lines A B, and C D, (Fig. 2.)

A Superficies, or Surface, is an Extension of two Dimen-

fions. viz. Length and Breadth.

A Plane or Plane Superficies is that with which a right

Line may every Way coincide.

A Plane Superficies receives several Denominations, according to the Number and Positions of the Lines by which is terminated, as follows:

Fig. 1. A Square is a right-angled equi-lateral Parallelogram, whose four Sides are equal, and its Angles all right ones.

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A Quadrangle is a Figure made by four strait Lines.

Fig. 2. A Parallelogram is a Quadrangle whose opposite Sides are parallel.

An Oblong, or Rectangle, is longer than broad; but it oppposite Sides are equal, and all its Angles right ones

A Rhombus, or Diamond Figure, is a Parallelogram whose Sides are all equal, but its Angles are not right Angles.

Fig. 3. A Rhomboides is an oblique-angled Parallelegram whose opposite Sides and Angles only are equal.

A Triangle is a Space included by three Lines, and of confequence hath three Angles; for every reallineal plane Figure hath as many Angles as Sides.

A right-angled Triangle is that which has one right An

gle, as Fig. in Page 201.

Fig. 4. An equi-lateral Triangle is that whose three Side are all equal to each other.

An isosceles Triangle is that which has only two of it

Sides equal to one another.

A Scalene Triangle is that which has all its Sides un equal.

An obtuse-angled Triangle is that which has an obtuse Angle.

An acute-angled Triangle is that which has every Ang

Fig. 5. A Trapezium is a Quadrangle, whose opposite Sid

All right lined Figures, having more than four Sides, are called Polygons, and receive their Names from the Number of their Sides or Angles.

ig 6. Having five Sides or Angles is called a Pentagon.

A regular Polygon is a Figure with equal Sides and equal Angles.

7. A Circle is a plane Figure ounded by a curve Line called the Circumference, every Part whereof is equally distant from a Point within called the Center.

A Diameter, AB, of a Circle is a right Line drawn thro? the Center, and terminated by the Circumference.

The Semi-Diameter, A C, is called the Radius.

A Semi-Circle is a Figure contained under a Diameter, and that Part of the Circumference of a Circle cut off by that Diameter, as the Line AB, divides the Circle into two Semi-Circles.

8. A Segment is any Part of a Circle terminated by an Arc, A D B cut off by the Line A B, called the

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two right Lines or Semi-Diameters and the intercepted of the Circumference.

10. represents the Front of an Arch built with Stones of

equal Length, and is a Segment of a Sector.

The hollow Side, A. B, of a Curve is called Concave, and

the raised Side, C D, Convex.

lar curve Line, returning into itself, but of its two Axes cutting each other in the Center, one of which is longer, (called the transverse Axis) than the other (called the conjugate Axis.)

Asolid is that which hath Length, Breadth, and Thick-

ness.

12. A Cube is a Solid bounded by fix equal Squares. I

13. A Prism is a Solid whose Sides are Parallelograms,

and whose two Ends are parallel to each other.

14. A Cylinder is a round solid, like the Rolling-Store of a Bowling-Green, whole two Ends are equal and parallel Circles.

A Pyramid is a Solid whose sase is a Polygon, or ight-lined Figure, and whose Sides or Triangles meet

a Point, C, called the Vertex

Fig. 16. A Cone is a round Pyramid, or Pyramid having a circular Base, in Form like a Sugar Loaf.

Fig. 17, 18. A Frustrum of a Pyramid or Cone is that Par which remains, when any Part next the Vertex is cut of

by a Plane parallel to the Base.

Fig. to. A Wedge is a Solid having a rectangular Base, I B, and two of the opposite Sides ending in an Acies o Edge, EF.

Fig. 20. A Pavilion is a Solid contained under five Planes the Base is a Rectangle or Oblong, and the four Side terminate in a Ridge, E.F., parallel to a Side of th Base, A.B., or C.D., but unequal to it.

Fig. 21. A Prismoid is a Solid contained under fix Planes the Bases, or Ends, are parallel Rectangles, and the fou

Sides are Quandrangles.

Fig. 22. A Sphere is a Solid bounded by a convex Surface every Point of which is equally distant from a Point, C within, called the Center.

· The Axis, or Diameter, of a Sphere is the right Lin

AB.

Fig. 23. A Segment of a Sphere is a Part cut off by a Plan A B. If the Plane pass through the Center of the Sphere, it will cut it equally in two, and each Hall

ca led a Hemisphere.

Fig. 24. A Spheroid is a Solid refembling an Egg, and is to Body conceived to be generated by the Revolution an Ellipse about its Axe, and is denominated eith prolate (oblong), or oblate, according as the Revolution is made about the transferse Axe or its conjugate

The Axe about which the Revolution is made is the fix Axe, the other is the revolving Axe.

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Fig. 25. A parabolic Spindle is eight-fifteenths of its circus ferribing Cylinder.

Fig. 26. is the middle Frastum of a Spheroid.

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# 70. SUPERFICIAL MEASURE.

#### PROBLEM I.

To multiply Feet, Inches, and Parts, by Feet, Inches, and Parts, which Method is termed Cross Multiplication, but more properly Duodecimal.

#### RULE.

Set the Feet in the Multiplier under the least Denomination in the Multiplicand, and the rest in Order, beginning with the least Denomination; divide each Product by 12, as you go on; place the first Remainder under the multiplying sigure, and the rest in Order, adding each Quotient to the next arising Product, as in Sect. 9. and having thus sinished Multiplication, the Sum of all will be the Product required.

#### In general, thus,

When Feet are concerned, the Product is of the same Demination with the Term multiplying Feet.

When Feet are not-concerned, the Name of the Product will be expressed by the Sum of the Indices of the two Factors.

#### EXAMPLES.

What is the Product of 10 Feet, 9 Inches, 9 Parts, by & Feet, 6 Inches, and 3 Parts?

1. By Duodecimals.	2. By Aliquot Parts.
F. " " Indices.	F. / //
Mul. 10:9: 9: 0:0 4'   8: 6:3	13 10:9:9
	86.6.0.0
2: 8: 5:3 2 5:4:10: 6:6 86:6; 0: 0:0	3:7:3:0
00:0:0:0:0	0:2:8:5:3
Prod. 92: 1: 6: 11: 3 P. as be	eforegz: 1 +6:11:3

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8,52083 3. By Decimals,

Product 92,131510414=92 F. 1', 6", 11", 3", as before

1. Multiply 17 Feet, 7 Inches, by 6 Feet.

2. Multiply 47 Feet, 8 Inches, by 8 Feet, 4 Inches,

3. Multiply ! Feet, to Inches, by 8 Feet, 6 Inches,

Multiply 64 Feet, 7 Inches, by 4 Peet, 8 Inches. 5. Multiply 12 Feet, 8 Inches, 9 Parts, by 9 Feet, 6 Inche

7 Parts.

6. Multiply 9 Feet, 11 Inches, 6 Parts, by 11 Feet, 8 Inches

7. Multiply 64 Feet, 10 Parts, by 14 Feet, 9 Inches. 8. Multiply 124 Feet, 4 Inches, by 42 Feet, 9 Seconds.

9. Muleiply 16 Feet, 7 Inches, 10 Parts, by 6 Feet,

Inches, 7 Seconds.

10. Multiply 474 Feet, 6 Inches, 8 Seconds, by 186 Feet Inches, 4 Seconds.

11. Multiply 24 Feet, 11', 8", 6", 7, by 8 Feet, 6', 7'.

12. Mules 46 Feet, 6 In. 8", 4", by 6 Feet, 4 In. 8", 6

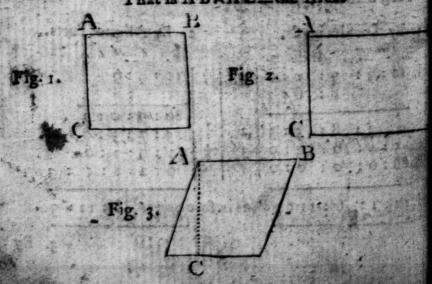
PROBLEM IL

To find the Area of a Parallelogram, whether it b Square, a Rectangle, a Rhombus, or a Rhomboides.

RULE.

Multiply the Length by the Height or perpendict Breadth, and the Product will be the Area.

That is A B x A C=the Area.



#### X A M P L E S. E

What is the Area in Acres of a Parallelogram whose Length is 14,5 Chains, and its Breadth 9,75 Chains.

What is the Area of a Square whose Side is 245 Yards or

Chains. &c.

How many square Yards of Paying are there in a Court-Yard, being in the Form of a Rhombus or Rhomboides. whose Length is 64 Feet, 6 Inches, and perpendicular Breadth is 47 Feet, 8 Inches?

the Area of a Field, in Yards, is divided by 4840, (the Number of square Yards in one Acre; the Quotient will

give the Number of Acres in that Field.

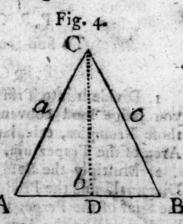
#### PROBLEM

To find the Area of a Triangle.

#### RULES.

Multiply one of its Sides by the Perpendicular let fall upon it from its opposite Angle, and Half the Product will be the Area, Planto And asked and

Multiply the Base by Half the Perpendicular, or Perpendicular by Half the Base, and the Product gives the Area.



That is A BxC D = the Area.

## EXAMPLES.

low many Acres are in a triangular Field, whose Base is

28, and Perpendicular 20,5 Chains?

Triangle Field 738 Links long, and 583 in the Perpendicular, brings in 12/, a Year: What is it let at per Acre?

Area of a Field in Links is divided by roocoo (the Number of square Links in one Acre) the Quotient will be the express Number of Acres in that Field.

When

When the three Sides of a Triangle are given, to find the Area.

RULE.

3. From Half the Sum of the three Sides subtract each Side severally; multiply the Half Sum and the three Remainders continually together, and the Square Root of the last Product will be the Area of the Triangle, that is, \(\frac{a+b+c}{2}\)

5—Half the Sum of the Sides.

Then let s=a=e, and s=b=f, also s=c=g;  $\cdots \sqrt{sef}$  = the Area.—Note, a=A C, b=A B and c=B C. So the last Figure.

#### EXAMPLE.

6. Suppose I have a Fish-Pond of a triangular Form, who three Sides measure 400, 348, and 312 Yards; who Quantity of Ground does it contain.

PROBLEM IV.

To find the Area of a Trapezium.

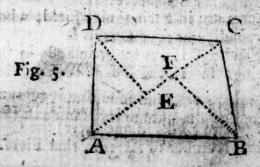
RULES.

1. Divide it into Triangles according to the Manner whi you judge most convenient; then the Sum of the Areas those Triangles, calculated by the last Problem, will bet Area of the Trapezium. Or,

2. Multiply the Sum of the Perpendiculars by Half to Diagonal, and the Product will give the Area; or multiple the Sum of the Perpendicular by the Diagonal, and Half to

Product will be the Area.

That is  $\frac{DE+BF}{2} \times AC$  = the Area.



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or A

Molt Mui ble, How many square Yards of Paving are there in a Trapezium, ABCD, whose Diagonal, BD, 45 Feet, and the Perpendiculars, AE, equal to 17,25, CF, equal to 14 Feet.

#### PROBLEM V.

To find the Area of any regular Polygon.

#### RULE.J.

Let fall a Perpendicular from the Center of the Figure to he of its Sides, then multiply together the Perpendicular, he Side of the Figure, and the Number of its Sides, and Half he Product will be the Area.

Here the Number of Sides is 5=N.

wh

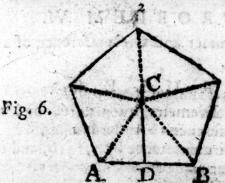
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Then it is ABXC Dxn \_ the Area.



### EXAMPLE.

A Piece of Garden Box lies in Form of a regular Pentagon, or Figure of five equal Sides, (as above) each 48 Feet; and from the Center of the Figure, C, to the Middle of one of its Sides, D, it measures 41,57 Feet nearly, the Area of the Figure will be the Content of these five Triangles. Pray, what is that?

#### RULEOIL

Multiply the Square of the Side of any regular Figure by Multiplier standing opposite to its Name in the following ble, and the Product will be the Area.

Aa

No.

oloi Stari

No. of Sides.	Names. 1	Multipliers.
3	Trigon or equal A	0,433013
s vc <b>4</b> :519	Tetragon or Square.	1,000000N
5	Pentagon,	1,720477
6	Hexagon.	2,598076
7	Heptagon.	3,633912
8	Octagon.	4,828427
9	Nonagon.	6,181824
10	Decagon.	7,694209
II	Undecagon.	9,365641
12 A	Duedecagon.	11,196152

#### EXAMPLES.

9. What is the Area of an Hexagon, whose Side is 30? 10. What is the Area of an Octagon whose Side is 24?

#### PROBLEM VI.

To find the Diameter and Circumference of a Circle, to one from the other.

## RULES:

1. Multiply the Diameter by 3,1416, and the Prod will be the Circumference. And therefore,

2. Divide the Circumference by 3,1416, and the Quotiently will be the Diameter.

3. See Sect. 54, Cafe 3.

# probable along E X A M P L E S.

11. If the Diameter of a Circle be 7, what is the Circum

12. What is the Diameter of a Circle whose Circumserence

33. What is the Circumference of the Earth, supposing in be perfectly round, and its Diameter is 8000 Miles?

# PROBLEM VII.

T

To find the Area of a Circle.

RULES.

ter, and the Product will be the Area. Or,

2. Multiply the Square of the Diameter by, 7854, and the Product will be the Area. Or,

3. Multiply the Square of the Circumference by ,079574,

and the Product will be the Area. Or a

4. Multiply the Square of the Semi-Diameter by 3,1416 and the Product will be the Area. Or

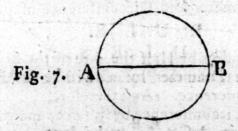
3. Multiply the Circumference by the Diameter, and a

fourth Part of the Product will express the Area.

Note, ,7854, and 3,1416, are Areas of Circles whose Diameters are 1 and 2, and ,079577 is the Area of a Circle whose Circumference is 1; likewise 452, and 1,273239, are squares of the Diameters of Circles, whose Areas are 355, and 1, and 1,12831 is the Diameter of a Circle whose Area is equal to a Square whose Side is 1.

Let C=the Circumference and D=the Diameter, A B.

Then per Rule I.  $\frac{C}{2} \times \frac{D}{2}$  the Area.



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#### EXAMPLES.

How many Square Feet are in a Circle whose Circumference is 6, 2832?

What is the Area of a Circle whose Diameter is 12?

#### PROBLEM VIII.

To find the Length of any Arc of a Circle, A D B.



Aaz

RULE.

#### RULE.

Multiply together the Radius, D E, the Number of De grees in the given Arc, and the Number, 01745329, (b) the last Product will be the Length of the Arc; for, when the Radius is 1, Half the Circumference is 3,14159265, & and therefore, \frac{3,14159265}{180 Degrees} =,01745329252 nearly, which the Length of an Arch of 1 Degree.

Hence E D A D Bxb=the Length of the Arc, A D B.

#### EXAMPLE.

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Fig

16. What is the Length of the Arc, ADE, which is 29.
Degrees, and Radius 9.

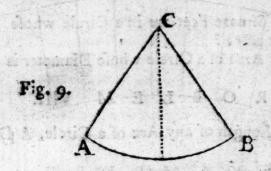
#### PROBLEM IX.

To find the Area of any Sector of a Circle.

#### RULE.

Multiply the Radius by Half the Arc of the Sector, for by the last Problem, and the Product will be the Area, as the whole Circle.

That is,  $A \times \frac{A B}{2}$  = the Area.



#### EXAMPLE.

and the Length of the Arc, A B, 59.

PROBL

# PROBLEM X.

To find the Area of the Segment of a Circle, ADB, whose Center is E. (See Fig. in Prob. VIII.)

# ROCHES IS Half Carenison

Find the Area of the Triangle ABE, by Prob. III. and of the Sector, ADBE, by the last Problem, their Difference, or Sum of these Areas, will be that of the Segment, according as it is less or greater than a Semi-Circle.

# EXAMPLE.

18. What is the Area of a Segment whose Arc is a Quadrant or contains 90 Degrees, and Diameter 18 Feet?

#### PROBLEM XI.

To find the Area of a Segment of a Sector, ABCD, or the Fronts of an Arch built with Stones of equal Length.

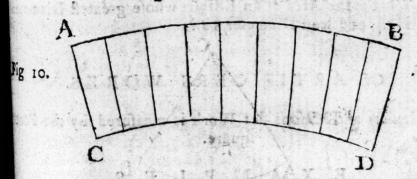
#### RULE.

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DBL

Multiply Half the Sum of the bounding Arches, ABC D, by the Distance, AC, and the Product will give the Area.

That is 
$$\frac{AB+CD}{2} \times AC$$
 = the Area nearly.



#### EXAMPLES.

What is the Area of the Front of an Arch built with Stones 3½ Feet long, whose upper and lower bounding Arcs are in Length 84 and 72½ tespectively?

Ha3

20. What

20, What is the Area contained between two concentric Seami Circles, whose Diameters are 24 and 167 all and 100 al

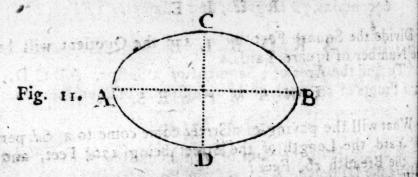
# each Winter i Mh 3 Rat 8 I Ohen will be glazing come to at 164, per Poor

To find the Area of an Ellipsis, or Oval.

# A Looking Galais . 3 "How y R and contains a Foot

Multiply continually together the two Axes, and the Number, 7854 (b) and the Product of these three Numbers will express the Area.

That is, bx A BxC D the Area.



# EXAMPLE.

21. What is the Area of an Ellipsis whose greatest Diameter is 24, and least Diameter 18?

# Of ARTIFICERS WORKS.

1. Glaziers and Masons flat Work is measured by the Foot square.

# EXAMPLES.

3 Feet 10 Inches long, and 2 Feet 8 Inches broad What will the Glazing come to at 81d. per Foot?

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the Height of the first Tier is 6 Feet 6 Inches, the second 54 Feet, and the third 44 Feet, the Breadth of each Window is three Feet 9 Inches; what will the glazing come to at 16d. per Poot?

What is the Price of a Marble Slab whose Length of 61

Feet, and Breadth 31 Feet, at 8s. per Foot?

A Looking-Glass is 16 Inches by 9, and contains a Foot of Glass; what will the Content of the Plate be that has twice the Length, and three Times the Breadth?

Il Painting, Plaistering Paving, &c. is measured by the Yard Square, Mich is 9 Square Feet.

#### RULE.

Divide the Square Feet by 9, and the Quotient will be

#### EXAMPLES.

What will the paving of a Street come come to at 6d. per Yard, the Length of the Street being 176½ Feet, and the Breadth 56¾ Feet?

What is the Content of a Piece of Wainscotting in square Yards, that is 9½ Feet in Height, and 8½ Feet broad,

and what will it come to at 6. per Yard?

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There is a Room 84 Feet round, and 9 Feet 6 Inches high, in which are three Windows, each 6 Feet high, and 3 Feet 5 Inches wide, and the Fire Place 4 Feet by 4 Feet; I demand how many Yards of Paper, Half-Yard wide, will hang it?

If my Court Yard be 47 Feet 7 Inches square, and I have laid a Footway of Purbeck Stone 4 Feet wide along one Side of it; what will paving the rest with

Flints come to, at 6d. per Yard square?

rectangular four-fided Room measures 129½ Feet about, and is to be wainscotred at 31. 6d. per Yard square; after the due Allowances for Girth of Cornice and Member, it is 16½ Feet high; the Door is seven Feet by 3½ Feet, the Window Shutters, two Pair, are 7½ Feet by 4½ Feet; the Check Boards round them come

Breadth; the lining Boards round the Door Way are 16 Inches broad; the Door and Window Shutters being wrought on both Sides, are reckoned Work and half and paid for accordingly; the Chimney 3½ Feet by Feet, not being inclosed, is to be deducted from the superficial Content of the Room; and the Estimate of the Charge is required?

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lefs,

to. What will Plaistering of a Cieling, at 101d, per Yard come to, supposing the Length 341 Feet, and the

Breadth 20 Feet?

Feet 8 Inches about, and 14½ Feet high; but is rendered between Quarters: The Lathing and Plaisterin will be 8d. per Yard, and the Whiting 2d. per Yard what will the Whole come to?

Note, In measuring Plaistering rendering between Quarter there is commonly a fifth Part of the whole Are deducted; but when rendering between Quarters whited or coloured, there is commonly a fourth fifth Part added to the whole Area, for Sides of the Quarters and Braces, &c.

III. FLOORING, PARTITIONING, ROOFING, TYLING, & is measured by the Square of 100 Feet.

In these Measurements, the Dimensions are taken by Rod of 10 Feet long; and therefore the Result is in Square of 100 square Feet each.

Hence, dividing the Area in square Feet by 100,

Quotient will be the Number of Squares required.

#### EXAMPLES.

12. In 1202 Feet in length, and 123 Feet in Height of P titioning, how many Squares?

by 20 broad, and two others that measure 14 Feet piece by 10; and what do all three come to, at 21. per Square?

Floor, was to be floored, at 81. 101. per Square,

House measures 30½ Feet by 20½ Feet, there are eight Fire Places, whose Measure are four of 6 Feet by 5¼, and four of 4½ Feet, by 4, and the Well Hole for the Stairs is 10 Feet by 8½; what will the Whole come to?

15. How many Oaken Planks will floor a Room 601 Feet long, and 331 wide, supposing the Plank 15 Feet long.

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Grou

re, Ho 16. Suppose a House measures, within the Walls, 64 Feet in Length, and 36 Feet in Breadth, and to be of a true Pitch, what will it come to roosing, at 125. 6d. the Square?

17. Suppose I employ a Person to thatch a Barn, which is 70 Feet long, and 30 deep; I demand how many Squares are contained in the Whole; also what it will

come to at 10s. 8d. per Square?

18. What will the new ripping an Out-House cost, that measures 322 Feet long, by 222 broad, upon the flat, at 150, the Square; the Eaves Boards projecting 10 Inches on each Side?

Note, In Tyling and Roofing, it is customary to recken the Flat, and Half of any Building within the Walls, to be the Depth or Width of the Roof of that Building; when the faid Roof is of a true Pitch, that is, when the Rafters are 3 of the Breadth of the Building: But when the Roof is more or less than the true Pitch, they measure from one Side to the other.

IV. BEICKLAYER'S WORK is measured by the Rod, of

This Work is always valued at the Rate of a Brick and Half thick, and if the Thickness of the Wall is more or less, it must be reduced to that Thickness, by the follow-

#### RULES.

Multiply the Area of the Wall in Feet, by the Number of half Bricks in the Thickness; divide the Product by 8163, and the Quotient will be the Content in Rods: Or,

2. Multiply

2. Multiply the Area of the Wall by the Number of hall Bricks the Thickness of the Wall is of; the Product divided by 3, gives the Area in Feet, which divide by 2721, the Quotient will be the Rods required.

Note, The Fraction 3 in Rule 1, or 1 in Rule 2, is rejected in Favour of the Workmen.

### EXAMPLES.

19. There is a Brick Wall 470 Feet round, and 9½ Feet high, and 3 Bricks thick, how many Rods doth it con tain?

20. A Geutleman built a Wall round his Garden, which is 840 Feet, and 9 Feet high, and 2½ Bricks thick; how many Rods doth it contain, and what will it come to

at 4/. 191. 6d. per Rod?

21. The End Wall of an House is  $24\frac{1}{2}$  Feet in Breadth, an 40 Feet to the Roof;  $\frac{1}{3}$  of which is two Bricks thick  $\frac{1}{3}$  more  $1\frac{1}{2}$  Brick thick, and the rest t Brick thick Now the Gable rises 38 Course of Bricks (4 of which usually make a Foot in Depth) and this is but 4 Inches or half a Brick thick: What will this Piece of Worksome to, at 51. 101. Statute Rod?

#### Questions for Exercise in Superficial Measure.

1. An Elm Plank is 141 Feet long, and I would have ju a Yard Square slit off; at what Distance from the Ed

must the Line be struck?

2. Having a rectangular Marble Slab, 58 Inches by 27, would have a Foot square cut off, parallel to the short Edge; I would then have the like Quantity divid from the Remainder, parallel to the longer Side, a this alternately repeated till there should not be to Quantity of a Foot left; what will the Dimension the Remainder be?

Rows, the Length of the Grove must be 6 Times to Breadth: How many of the shorter Rows will the

be?

A common Joist is 7 Inches deep, and 2½ thick; but I want a scantling just as big again, that shall be three luches thick; what will the other Dimensions be?

of the Timber in it (provided it be 9 Inches deep, will

ferve; how broad will it be?

6 I have a wooden Trough, that, at 6d. per Yard, cost me 3. 2d. painting within; the Length of it was 102 Inches, the Depth 21 Inches; what was its Breadth?

My Plumber has put 28lb. per Foot square into a Cistern 74 Inches, and twice the Thickness of the Lead long, 26 Inches broad, and 40 deep; he has put three stays within, across it 16 Inches deep, of the same strength, and reckons 22s. per cwt. for Work and Materials: I being a Mason, have paved him a Workshop, 22 Feet 10 Inches broad, with Purbeck Stone, at 7d. per Foot, and upon the Balance I find there is 3s. 6d. due to him; what was the Length of his Workshop?

The rectangular powdering Trough of a Man of War measures 27 square Feet 112 Inches, the Depth is 20

Inches, the Breadth 16: The Length is fought?

In 110 Acres of Statute Measure, in which the Pole is 16½ Feet long, how many Cheshire Acres, where the Customary Pole is 6 Yards long? And how many Yorkshire, where the Pole in Use is seven Yards in Length?

olwould set 3584 Plants in Rows, each 4 Feet asunder, and the Plants 7 Feet apart, in a rectangular Plot of

Ground; what Land will this take up?

The paving of a triangular Court, at 18d. per Foot, came to 100l. the longest of the three Sides was 88 Feet; what then was the Sum of the other two equal Sides?

An ancient Bath was found of a triangular Form, the Sum of whose three equal Sides was 125 Feet; the Area of the Bottom is required? See Prob. III. Rule

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h l would plant 20 Acres of Hop-Ground, which must be done either in the square Order, as the Number 4 stands on the Dice, or in the quincunx Order, as the Number 5; the three nearest Binds, in both Cases, must

be fet lineally just 6 Feet afunder: How many Plants more will be required, for the last Order than for the first; admitting the Form of the Plot to lay the most advantageous for the Plantation in either Cafe?

14. A Summer House is a Cube of 10 Feet in the clear, Cornice of which projects just 15 Inches on a Side, and being of Timber and Stucco, the Sides are 6 Inches thick, fo that the whole Front of the Roof, from Out to Out, is 131 Feet; this is hipped from each of the Corners to the Centre, and being truly Pedimen Pitch, it rifes 2 of the Front or 3 Feet. I would, by Help of these Dimensions, measure the Slating withou venturing to climb for more, and compute the Col 31 per square Foot?

15. There are two Columns in the Ruins of Persepolis left standing upright; one is 64 Feet above the Plane, the the other 50; between these, in a right Line, stand an ancient Statue, the Head whereof is 97 Feet from the Summit of the higher, and 86 Feet from the To of the lower Column; the Base whereof measures ju 76 Feet to the Corner of the Figure's Base; by the Notices the Dillance of the Top of the Columns ma

be, by Number, easily found.

A triangular Bath, 6 Feet deep, is exactly inclosed by 3 square Pavilions, and rectangular, the Sum of who Planes together make just 50 Poles: The Area of A the less, is to that of B, the middle One, as 41 to 8 and the Sum of the Areas of A and C, the biggest, to that of B. as & to 4: How many Wine Hogshea of Water will this Bath receive?

17. I have an Orchard in the Form of a Quadrangle or Tr peze, containing 33 Acres, which being divided by Diagonal, or Line from Corner to Corner, the Pe pendicular of one of the Triangles is 430 Links, a the other 360; the Length of the faid Diagonal, common Base of those Triangles, is required?

Give the Area of a circular Bowling. Green that is Poles across the Middle, the Circumference bei

3,1416 Times the Diameter of a Circle?

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19. The surveying Wheel is so contrived as to turn just twice in the Length of a Pole, or 163 Feet; what then is the Diameter?

20. I would Turf a round Plot, measuring 130 Feet about, and would know the Charge, at 4d. per Yard square?

In I want the Length of a Line, by which my Gardener may strike a round Aurangerie, than shall contain just Half an Acre of Land?

12. Agreed for an Oaken Curb to a round Well, at 8d. per fquare Foot; it is exactly 42 Inches in Diameter, within the Brick Work, and the Breadth of the Curb is to be 14½ Inches, what will it come to?

13. It is observed, that the extreme End of the Minute-Hand of a public Dial moves just 5 Inches in the Space of 3½ Minutes: The Question is, what is the Length of that Index?

A B, and C, join for a Grinding-Stone, 36 Inches in Diameter, Value 20s. toward which A paid 7s. B Ss. and C 5s. the waste Hole through which the Spindle passed was 5 Inches square; to what Diameter ought the Stone to be worn, when B and C begin severally to work with it?

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As the Diameter of a Circle is the only necessary Dimension to find the greatest Square that may either be inscribed, or the least Square that may be circumscribed: Idemand what Difference there is in the Area of the Section of a round Tree, 20 Inches over, considered both those Ways; and how far the Result, from each of those Dimensions differ from the Truth in the circular Measure?

white Marble, at 25. 4d. per Foot; the Mason's Bill was just rol. what then was this Arch in Front, considering, that as ,7834 the Area of the Circle, the Square of whose Diameter is 1, so is the Area of any other Circle, to the Square of its Diameter?

What Proportion is there between the Arpent of France, which contains 100 square Poles of 18 Feet each, and the English Acre, containing 160 square Poles of 16½ Feet each, considering that the Length of the French Foot is to the English as 16 to 15.

Bb

28. In turning any one Horse-Chaise within a Ring of a certain Diameter, it was observed, that the outer Wheel made two turns while the inner made but one: The Wheels were equally high, and supposing them fixed at the statutable Distance, or 5 Feet asunder on the Axle Tree, pray what was the Circumference of the Track described by the outer Wheel?

29. The Area of a Sector, (supposing one of the Divisions of a Wilderness) which being struck from a Centre with a Line 30 Yards long, makes the sweep, or circular

Part, 63 Feet, is required?

30. If the Chord or Line drawn thro' the two Ends of the Curve be 15 Inches shorter than the Arch Line, I de-

mand the Segment?

31. The Ellipse in Grosvenor-Square measures 840 Links the longest Way, and 612 across, within the Rails; the Walls are 14 Inches thick; what Ground do they enclose, and what do they stand upon?

The Dimensions of all similar Figures are in Proportion to their Areas, as the Squares of their respective Sides, e contra.

32. If a round Pillar, 7 Inches over, has 4 Feet of Stone is it, of what Diameter is the Column, of equal Length that measures ten Times as much?

33. A Pipe of 6 Inches bore will be 3 Hours in running of a certain Quantity of Water: In what Time will Pipes, each 3 Inches bore, be in discharging double the Quantity?

34. A Yard of Rope 9 Inches round weighs, suppose 22ld what will a Fathom of that weigh, which measures Foot about?

35. If 20 Feet of Iron Railing shall weigh Half a Ton who the Bars are an Inch and Quarter square; what will seet of Ditto come to, at 3½ per lb. the Bars being by a of an Inch square?

36. A Looking Glass is 16 Inches by 9, and contains
Foot of Glass; what will the Content of the Pla
be, that has twice the Length, and three Timest

Breadth?

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- 37. A Sack that holds three Bushels of Corn is 22½ Inches broad when empty; what would the Sack contain, that being of the same Length, had twice its Circumference, or twice its Breadth?
- 38. My Plumber has fet me up a Cistern, and his Shop-Book being burnt, he has no Means of bringing in the Charge, and I do not chuse to take it down to have it weighed; but by Measure he finds it contains 64 square Feet 3, and that it was 3 of an Inch precisely in Thickness. Lead was then wrought at 21l. per Fodder.—Let the Accomptant, from these Items, make out the poor Man's Bill, considering farther, that 47 oz. is the Weight of a Cubic Inch of Lead?

# 74. MENSURATION of SOLIDS.

#### PROBLEM XIII.

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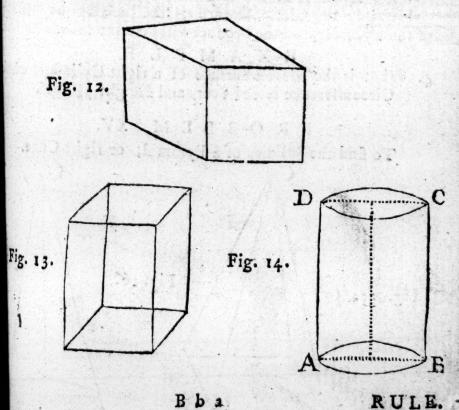
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37.

To find the Solidity of a Cube, Prism, or Right Cylinder



#### RULE.

Multiply the Area of the Base into the Height or Altitude, and the Product will be the Solidity.

#### EXAMPLES.

- 1. What is the folid Content of a Cube whose Side is 21/2
  Feet?
- 2. How many Ale Gallons of Water will a Cistern hold, whose Length, Breadth, and Depth, are 4 Feet 9 Inches, 3 Feet 6 Inches, and 2 Feet 10 Inches?

3. What is the Content of a Cylinder, whose Diameter is

#### PROBLEM XIV.

To find the Convex Surface of a Prifm or a right Cylinder

#### A GENERAL RULE.

Find the Area of each Side and End separately, then add those Areas together, and their Sum will be be the whole Surface of any Prism or Body whatever.

#### A PARTICULAR RULE.

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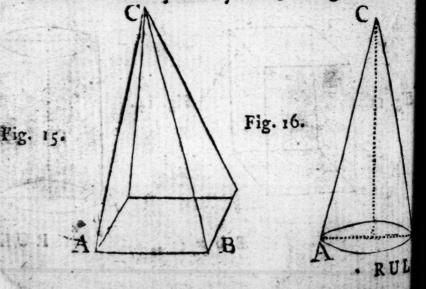
Multiply the Circumference of the Base by the Altitude of the Cylinder, and the Product will give the convex Surface

#### EXAMPLE.

4. What is the convex Surface of a right Cylinder, whole Circumference is 10½ Feet, and Height 7½ Feet.

#### PROBLEM XV.

To find the Solidity of a Pyramid, or right Cone.



#### R U L E.

Multiply the Area of the Base by a third Part of the Altitude, and the Product will be the Content required.

#### EXAMPLES.

5. Required the Solidity of a square Pyramid, each Side of whose Base is 12 Feet, and the slant Height 25 Feet?

6. What is the folid Content of a triangular Pyramid, whose Height is 30 Feet, and each Side of its Base 5½?

7. What is the Solidity of a Cone, whose Base is 3\frac{1}{2} Feet
Diameter, and Altitude 6 Feet?

#### PROBLEM XVI.

To find the convex Surface, a Pyramid, or Cone (as Fig-

RULE.

Multiply the Perimeter or Circumference of the Base by the slant Height or Length of the Side (A C) and Half the Product will be the Area.

#### EXAMPLES.

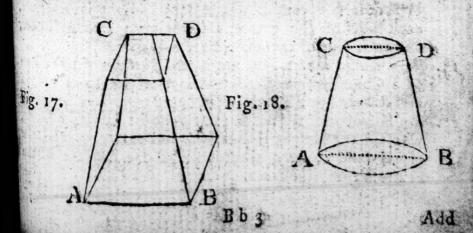
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8. What is the Surface of a triangular Pyramid, the flant Height being 20 Feet, and each Side of the Base 34?

9. What is the convex Surface of a right Cone, whose Base is 45 Feet in Circumserence, and slant Side is 20 Feet in Length?

## PROBLEM XWI.

To find the Solidity of a Frustum of a Pyramid or Cone:



Add into one Sum the Areas of the two Ends, and the mean Proportional between them; multiply the Sum by the perpendicular Height, and  $\frac{1}{3}$  of the Product will be the Solidity; that is, if A be the Area of the greater End, and a of the lesser, and b the Height.

Then A+a+ \( \text{Aa} \times \frac{1}{3}b = \text{the Solidity.}

#### EXAMPLES.

10. How many folid Feet are there in a Tree, whose Bases are Squares, each Side of the one being 15 Inches, and each Side of the other 6, and the Length measures along the Side 24 Feet?

11. What is the Content of the Frustum of a Cone 60 Feet high, the Diameter of its Ends being 20 and 3

Feet?

12. How many solid Feet are there in a conical Frustum, the Circumferences of whose Bases are 66 and 56 Feet, Height is 4 Feet?

#### PROBLEM XVIII.

To find the convex Surface of the Frustum of a Pyramid or right Cone.

### RULE.

Multiply the Sum of the Perimeters or Circumference of the Ends, by the flant Height, and Half the Product will be the Surface required.

#### EXAMPLES.

or a square Pyramid, whose slant Height is 10 Feet, each Side of the greater Base being 3 Feet 4 Inches, and each Side of the less 2 Feet 2 Inches?

14. How many square Feet are in the Surface of a Frustum of a Cone, whose Circumference of its Ends are 32

and 8 Feet, and flant Side 7 Feet ?

15. If a Segment of 6 Feet flant Height be cut off a Cone, whose flant Height is 30 Feet, and the Circumference of its Base 10 Feet, what will be the Surface of the Fiustum?

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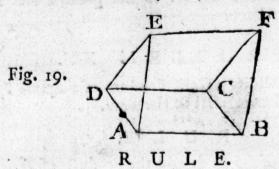
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#### PROBLEM XIX.

To find the Solidity of a Cuneus or Wedge.



Multiply the Area of the Base, ADE, or BCF, by Half the Altitude, DC, of the Wedge, und the Product will give the Solidity.

Thus,  $AD \times DE \times \frac{CD}{2}$  = the Solidity.

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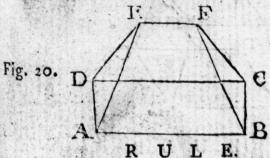
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#### EXAMPLE.

7. What is the Solidity of a Wedge, whose Base measures 30 Feet by 16, and whose Height is 12.

#### PROBLEM XX.

To find the Solidity of a Pavilion Roof.



To the Length of the Ridge, add twice the Side of the the which is parallel to it: Multiply the Sum by the Ber Side of the Base, and the Product which arises by a the Part of the Altitude, and the second Product will give Solidity.

Thus, EF+2 AB×B C×alt.

#### EXAMPLE.

18. What is the Solidity of a Pavilion Roof, whose Base is 36 by 20, Ridge parallel to the greatest Side 16, and Altitude 12 Feet?

#### PROBLEM XXI.

To find the Solidity of the Frustum of a square Pyramid made by a Section parallel to the Base.

#### R U L E.

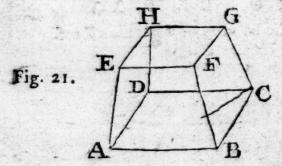
To the Areas of the Ends add the Product of their Sides multiply the Sum by a third Part of the Altitude, and the Product will give the Solidity.

#### EXAMPLE.

19. What is the Solidity of the Frustum of a Pyramid 6 Feet high, whose Ends are 16 and 13 Feet square.

#### PROBLEM XXII.

To find the Solidity of a Prismoid.



#### RULE.

2 (144) 2 2 7 1 2

To the Area of the Ends, add the Product of the Su of the Lengths and Breadths; multiply this Sum by a fix Part of the Altitude, and the Product will give the Solidity

Thus, ABXBC+EFXFG+AB+EFXBC+FG+alt

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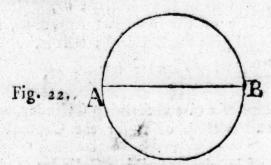
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#### EXAMPLE.

10. What is the folid Content of a Canal 304 Feet by 20 at Top, 300 Feet by 16 at Buttom, and 5 Feet deep?

#### PROBLEM XXIII.

To find the Surface of a Sphere or Globe, or of any Segment or Zone of it.



#### A GENERAL RULE.

Multiply the Circumference of the Sphere into the Diameter or Height of the Part required, and the Product will be the curve Surface, whether it be Segment, Zone, Hemisphere, or the whole Sphere.

Note, The Height of the whole Sphere is its Diameter.

#### PARTICULAR RULE.

by Prob. VI. Rule I. or by multiplying the Radius by 6,2832, multiply the Circumference by the Diameter, and the Product will give the Superfices. Or,

2. Multiply 3, 1416 by the Square of the Diameter, and the Product will give the Superfices.

## EXAMPLES.

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- 21. What is the Surface of a Globe, whose Diameter is 7?
  22. What is the Surface of a Globe, whose Semi-Diameter is 6 Inches?
- 3. If the Diameter or Axis of the Earth be 7957 Miles, what is the whole Surface, supposing it a perfect Sphere?
- 4. What is the Superfices of a Segment 9 Feet high, cut from a Globe of 42 Feet Diameter?

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#### PROBLEM XXIV.

To find the Solidity or Content of a Sphere or Globe (fee Fig. to Prob. XXIII.)

#### RULES.

perficies by  $\frac{1}{3}$  of the Radius, or by  $\frac{1}{6}$  of the Diameter and the Product will be the Solidity; or,

2. Multiply the Cube of the Diameter by ,5236, and the Product will give the Solidity; that is,

$$\frac{3.1416}{6} = 5236d.^3$$
 the Solidity; or,

3. Find the Content of a circumfcribing Cylinder, by Problem XIII, and take <sup>2</sup>/<sub>3</sub> of it for the Content of the Globe.

For a Globe is  $\frac{2}{3}$  of its circumferibing Cylinder, and ,523 is the Content of a Globe whose Diameter is 1.

#### EXAMPLES.

25. What is the Content of a Globe whose Diameter is 7
26. Suppose the Earth to be spherical, and its Diameter 7957 Miles, what is its Solidity?

#### PROBLEM XXV.

To find the Solidity of the Segment of a Globe, Fig. 23.

RULE.

1. From three Times the Diameter of the Globe, take twe the Altitude of Segment; multiply together the Remaind the Square of the Altitude, and 0,5236, and this Produced will give the Solidity.

Thus, let b=CD the Height of the Segment. Then 3cc-2cd×.5236×bb=the Solidity of ACB. Mu

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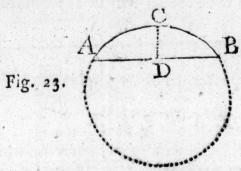
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2. To three Times the Square of the Radius of its Be add the Square of its Height; multiply the Sum by Height, and that Product again by ,5236, will give Solidity.

That is, if r=A D, the Radius of its Base, b=C D, the Height. Then  $5^{2}36b \times 3^{r}r \times bb$  the Solidity of the Segment ABC.

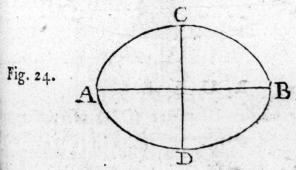


EXAMPLE.

What is the Solidity of a Segment 4 Feethigh, cut from a Globe 18 Feet Diameter?

#### PROBLEM XXVI.

To find the folid Content of a Spheroid.



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#### RULE

Multiply continually together the fixed Axis, the Square the revolving Axis, and the number 5235, (being  $\frac{1}{6}$  of 14159 nearly) and the last Product will be the Content remed; that is, if p=3,14159, &c. t=1 Transverse, and the conjugate Axis of the generating Ellipse.

Then is pitc=the oblate, And is picc=the oblong Spheroid.

RULE.

#### RULE II.

Multiply the Area of the generating Ellipse by \frac{2}{3} of the revolving Axis, and the Product will be the Content of the Spheroid.

Let A=the Area of the Ellipse, then from the former Rule

2 1A=the oblate,

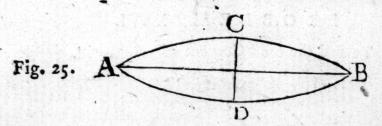
And \( \frac{2}{3} \) cA=the oblong Spheroid.

#### EXAMPLE.

28 What is the folid Content of a Spheroid, whose Dia meter of the greatest Circle is 33 Inches, and th Length 35 Inches?

#### PROBLEM XXVII.

To find the Solidity of a Parabolic Spindle.



#### R U L E.

7. The Square of the Diameter (CD) of the greate Circle, multiplied by ,41888, (being  $\frac{8}{15}$  of ,7854) and the Product again by its Length (AB) will be the Solidity.

2. Multiply the Area of the greatest Circle, or mide Section, by the Length, and  $\frac{s}{15}$  of the Product will be

Content.

That is, if A B=the Length or Axis D E=the great Diameter, or double the Abscissa of the generating Parabo A C B, and n = .785398. Then  $\frac{8}{15}n \times D$  C<sup>2</sup> × A B=t whole Solid, A D B C A.

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#### EXAMPLE.

29. What is the Solidity of a Parabolic Spindle, whose greatest Diameter is 36, and its Length 99 Inches?

#### PROBLEM XXVIII.

To measure Timber.

A square Piece of Timber, equally thick at both Ends, is a Prism; a round Piece, equally thick at both Ends, is a Cylinder; a square Piece, that tapers regularly, is the Frustum of a Pyramid; and a round Piece, that tapers regularly, is the Frustum of a Cone: and the Contents of these solids may be exactly computed by their respective Rules.

But because the Mensuration of tapering Timber by the each Rules is troublesome, an Approximation has taken Place, and the Contents of such Trees are generally computed by the following

R U L E.

Multiply the Square of the Quarter Girt (or a of the Circumference) in Inches, by the Length in Feet, divide the Product by 144, and the Quotient will be the Content in Feet.

But to find the Content more near the Truth, observe the following

R U L E.

Multiply the Square of \( \frac{1}{3} \) of the Girt or Circumference

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by twice the Length, and the Product will be the Content, atteamly near the Truth.

REMARKS.

The Girt of a Piece of Timber is its Compass or Circumference at the Middle, & of which is commonly taken for the Side of a Square equal to the Area of the Section there.

Trees of regular Growth must be measured in Parts or Pieces, as above directed.

Allowance must be made for the Thickness of Bark (if on the Tree) in Oak, or 12 in other Wood not so much. When the Timber is to be reduced to Loads,

Divide the Feet in { rough } by { 40 } gives the Load.

40 Feet make one Load of rough Timber, and 50 one hewn.

Cc

#### EXAMPLES.

30. What is the Content of a Tree, whose Girt is a Inches, and Length 16 Feet?

31. What is the Content of a Tree, whose Compass is 6

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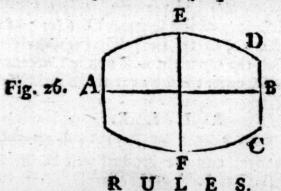
Inches, and Length 301 Feet?

32. How many Loads of Timber are there in a hewn Tre whose Breadth is 42 Inches, Depth 30 Inches, an Length 40 Feet?

#### GAUGING of CASKS.

#### PROBLEM XXIX.

The Bung Diameter EF, Head Diameter CD, as Length of the Cask AB (within Side) being given; to see the Content of a Cylinder nearly equal to it.



Area of the Circle of the Head, multiply the Sum one-third of the Length of the Cask, the Product is Content in Cubic Inches, which are converted it Gallons, by dividing by 282 for Ale, and 231 for W Gallons; or,

2. To the Square of the Head Diameter add twice that the Bung Diameter, and from the Sum take <sup>2</sup>/<sub>3</sub> of Square of the Difference of the faid Diameters; the multiply the Remainder by the Length of the Ca

then if the Product be multiplied

by \ \ \begin{align\*} \cdot 00092837 & \text{ or divided 1077,157 for Ale the left of 13333 by 882,35 Wine dud Quotient will be the Measure in Gallons.

#### EXAMPLES.

13. What is the Content of a Cask, whose Bung Diameter, Head Diameter, and Length is 32, 26, and 40 Inches, within Side respectively?

4. Suppose the Bung Diameter of a Cask to be 40 Inches, Head 36, and Length 64, required the Content both in Ale and Wine Gallons?

QUESTIONS for Exercise in MENSURATION of Solids.

What is the Difference between a folid half Foot, and half a Foot folid?

What is the Proportion, in Space, between a Room 25 Feet long, 20 Feet 2 Inches broad, 14 Feet high, and

two others of just half the Dimensions?

Another Room is 17 Feet 7 Inches long within, 13 Feet 10 Inches broad, and of Feet high; it has a Chimney carried up straight in the Angle, the Plan whereof is just the Half of 51 Feet, by 4 Feet 2 Inches: The Question is, How many Cubic Feet of Air the same will contain, allowing the Content of the Fire Place and Windows at 4 folid Yards?

A Ship's Hold is 1121 Feet long, 32 broad, and 51 Feet deep; how many Bales of Goods, 3 Feet 4 Inches long, 2 Feet 2 Inches broad, and 3 Feet deep, may be stowed therein, leaving a Gang-Way the Whole 41 Feet

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I want a rectangular Cistern, that is 16lb. to the Foot square, shall weigh just a Fodder of Lead, it must be 8 Feet long, and 41 over; how many Hogsheads, Wine Measure, will this Cistern contain, taking it at & of an Inch from the Top.

Alog of Timber is 181 Feet long, 18 Inches broad, and 14 Inches thick, die square althrough; now if 2 folid Feet and half be fawed off the End, how long will

the Piece then be?

The folid Content of a square Stone is found to be 1261. Feet, its Length is 81 Feet: What is the Area of one End, and what the Depth, if the Breadth affigned be 381 Inches ?

8. The Dimensions of the circular Winchester Bushel are 18½ Inches over, and 8 Inches deep: How many Quarters of Grain will a square Bin hold, that measures 7 Feet 10 Inches long, 3 Feet 10 broad, and 4 Feet 2 deep within?

the Diameter of a circular Measure be, which at 12 Inches deep will hold o Bushels of Sea Coal struck?

10. A Prism of two equal Bases, and fix equal Sides, that measure 28 Inches across the Center, from Corner to Corner; the superficial and the solid Content is required, taking the Length at 134 Inches?

am to cut off three Cubic Feet from one End; wherea.

bouts must the Section be made?

12. I would have a Syringe, 14 Inch in the Bore, to hole a Pint (Wine Measure) of any Fluid; what must the Length of the Piston, sufficient to make an Injection with it, be?

13. I would have a Cubic Bin made capable of receiving just 13 Quarters of Wheat, Winchester Measure; what

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will be the Length of one of its Sides?

14. A Bath Stone, 20 Inches long, 15 over, and 8 deep weighs 220lb. how many Cube Feet thereof will freight

a Ship 200 Tons?

a round strait Tree in the Middle, and to take fof the Girt for the Side of a Square, equal to the Area of the Section there; if this be not considered in the Price a pointed, pray on which Side lies the Advantage?

a Cylinder of the same Diameter, 20 Inches long, a a Cone 20 Inches Diameter at the Base, and 20 Inches high, are severally required; and also what they w

cost painting, at 8d. per Yard?

Miles: I require how many Quarters of Wheat would contain, if hollow, 215014 folid Inches be the Bushel; and how much Yard wide Stuff no make her a Waistcoat, was she to be cloathed?

18. Suppose the Atmosphere, or Body of the Air, and pours, surrounds the Globe of the Earth and Sea to

Miles above the Surface, and the Earth is 7970 Miles in Diameter; how many Cubic Yards of Air then hang

about, and revolve along with this Planet?

10. A square Pyramid, whose Sides at the Base measure 30 Inches a-piece, and is 20 Feet high by the Slope in the Middle of each Side of the Base, is to be sold at 75. per folid Foot; and if the polishing the Surface of the Sides will be 8d. per Foot more, I would know the Cost of this Stone when finished?

20. A round Marsh-Vat measures at the Top 72 Inches over within, at the Bottom 54, the perpendicular Depth being 42 Inches, the Content in Ale Gallons is required?

21. The Shaft of a round Pillar, 16 Inches in Diameter at the Top, is about 8 of the Bottom Diameters in Height, whereof is truly cylindrical, and the other 2 swelling, but we will suppose it tapers strait, and that it is } less at the Top than at Bottom; the Price of the Stone and Workmanship is sought, at 35. 6d. per Cubic Foot, and farther, the superficial Content; including both Ends.?

22. A flick of square Timber tapers strait; the Side of the greater End is 191 Inches, at the less 131 Inches, the Length 161 Feet 6 Inches; the Value, at 2s. 6d. per

Foot folid, is demanded?

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23. What Quantity of Brandy will the Distiller's Tun contain, that measures 40 Inches within at Head, 52 at Bung, and 100 Inches long; and how many Barrels of London Ale would fill it?

24. Suppose the Globe or Ball, on the Top of St. Paul's Church, to be 6 Feet in Diameter; what did the gild-

ing thereof come to, at 31d. per Inch square?

25. The famous Tun of Heidelburgh, that being heretofore annually replenished with Rhenish, had in it some Wine that was many Ages old; before the French demolished it in the late War, it was 31 Feet in Length, and 21 in Diameter, and pretty nearly cylindrical: Pray how many Tuns of Wine would the same contain?

#### 75. SPECIFIC GRAVITY of METALS.

The specific Gravity of a Body, is the Relation that the Weight of a Body of one Kind hath to the Weight of an equal Magnitude of a Body of another Kind; the Knowledge of which is of great Use in computing the Weights of such Bodies as are too unweildy to have their Weight discovered by other Means.

The following TABLE shews the specific Gravity to Rain Water, of Metals, and other Bodies; and the Weight of a Cubic Inch of each, in Parts of a Pound Avoirdupoise, and of Ounces Troy, and Parts of an Ounce.

BODIES.	Sp. Grav.	w. lb. avoir.	wt. oz. troy.
Fine Gold	19,640	0,7103587	10,359273
Standard Gold	19,520	0,7060185	9,962625
Coaft Cold	18,888	c,6828703	9,911707
Quick Silver	13,762	0,4976574	7,384411
Lead	11,313	0,4091696	5,984010
Fine Silver	11,091	0,4011501	5,850035
Standard Silver	10,629	0,3844400	5,556769
Caft Silver	10,528	0,3807870	5,503967
Copper	8,769	0,3171658	4,747121
Plate Brass	8,350	0,2942593	4,404273
Caft Brass	8,104	0,2929832	4,272409
Steel	7,850	0,2839265	4,142127
Bar Iron	7,764	0,2808159	4,031361
Block Tin	7,238	0,2417901	3,861519
Caft Iron	7,135	0,2580647	3,806568
Load Stone	5,106	0,1846788	2,724083
Blue Slate	3,500	0,1264914	1,867272
Veined Marble	2,702	0,0977286	1,429411
Common Glass	2,600	0,0940393	1,360841
Flint Stone	2,582	0,0933883	1,351419
Portland Stone	2,570	0,0929543	1,345139
Free Stone	2,352	0,0915788	1,231038
Brick	2,000	0,0723379	1,046801
Alabaster	1,888	0,0683061	0,988456

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			-95
BODIES.	Sp. Grav.	wt. lb. avoir.	wt. oz. troy.
Ivory } Hera	1,832	0,0662606	6,958489
Brimstone Clay Lignum-Vitæ Coal Pitch	1,800 1,712 1,327 1,255	0,0651042 0,0619213 0,0479862 0,0553921	0,949424 0,902498 0,699936 0,661050
Mahogany Wood Dry Box Wood Milk	1,063	0,0415943	0,606759 0,560691 0,543282
Sea-Water S Rain Water Red Wine Bees Wax Linseed Oil Proof Spirits 3 or Brandy Dry Oak.	1,033 1,000 0 993 9 995 0,932 0,927 0,915	0,0372530 0,0361690 0,0359158 0,0359881 0,0337095 0,0335503 0,0330946	0,543742 0,527458 0,523766 0,524820 0,491591 0,489268 0,489008
Olive Oil Beech Dry Elm Dry Afh Dry Weig Control	0,854	0,0330222 0,0308883 0,0289352	0,481569
Dry Wainscot Dry Yellow Fir Cedar Dry White Deal Cork Air	0,747 0,657 0,613 0,569 0,240 0,0012	0,0270182 0,0237630 0,0221715 0,0205801 0,0186805 0,0000434	0,394011 0,346539 0,323332 0,300123 0,126590 0,000633

# CASE I.

The linear Dimensions, or Solidity of any Body being

# RULE.

Multiply the Cubic Inches contained in that Body by the Tabular Weight corresponding will give the Weight, in Jounds Avoirdupoise, or Ounces Troy.

## EXAMPLES.

Form, whose Solidity is 12096 Cubic Inches?

2. What is the Weight of a Piece of Fir, whose Girt is 20

Inches, and Length 40 Feet?

3. What is the Weight of an Iron Shot, of 7 Inches Diameter?

4. What is the Diameter of an Iron Shot, weighing 42lb.

Avoirdupoise?

5. What is the Weight of an Iron Bomb Shell, of 3 Inches thick, the greatest Diameter being 16 Inches?

6. Required the Weight of one of the Portland Key Stones, to the middle Arch of Westminster-Bridge, the Diameter of the Arch being 76 Feet, the Height of the Key Stone 5 Reet, the Chord of its greatest Breadth, to the Front of the Arch, 3 Freet 4 Inches, and its Depth of the Arch 4 Feet?

7. In the Walls of Balbeck, in Turkey, there are three Stones laid End to End, now in Sight, that measure in Length 61 Yards; one of which in particular is 63 Feet long, 12 Feet thick, and 4 Yards over: Now if this Block was Marble, what Power would balance it, so as to prepare it for moving?

#### CASE II.

The Weight of any Body being given to find the Solidity, and the specific Gravity thereof.

#### RULE.

Divide the given Weight by the Tabular Weight corresponding to the Name of the same Kind, and the Quotien will be the Solidity in Cubic Inches.

#### EXAMPLES.

8. What will a Block of Marble, weighing 8 Tons, 14 cm come to, at 6s. per Foot folid?

9. Suppose that a Man of War, with all its Ordnance, Rig ging, and Appointment, draws so much Water as displace displace 1300 Tons of Sea Water, London Beer Mea-

fure: The Weight of the Vessel is required?

that raises a Fluid an Inch, in a Vessel three Inches square, when put into it; and supposing the Workman had adulterated the said Chain with 14½ Ounces of Silver, how much higher would the Water, upon its im-

mersion, being raised in the Vessel?

.

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11. Hiero, King of Sicily, ordered his Jeweller to make him a Crown, containing 63 Ounces of Gold; the Workmen thought substituting part Silver therein, to have a proper Perquisite, which taking Air, Archimedes was appointed to examine it, who, on putting it into a Vessel of Water, sound it raised the Fluid, or that itself contained 8,2245 Cubic Inches of Metal, and having discovered that the Cubic Inch of Gold more critically weighed 10,36 Ounces, and that of Silver but 5,85 Ounces, he, by Calculation, sound what Part of his Majesty's Gold had been changed, and you are desired to repeat the Process?

# TUTOR'S GUIDE.

#### PART V.

# 76. CHRONOLOGY

Is the Art of estimating and comparing together the Times when any memorable Transaction hath happened, such as are related in History, whether civil or ecclesiastical.

It also takes a View of the various Facts, Calenders and Methods of computing Time, practifed by different Nations, compares them together, and settles such Order and Harmony among them, that the exact Time in which any remarkable Event happened may be certainly known.

	of the	before
	World.	Christ
Some have dated their Events from the ?  Creation of the World	C000	4004
Others from the Deluge or Flood -	1656	2348
The Greeks from their Olympiads of 43	3228	1776
The Romans from Nabonassar, King of	3257	753
Some Historians from the Death of Alex-	3676	324
We from the Birth of Christ -	4004	A. D.
The Mahometans from the Flight of Ma- } homet, and called the Hengira	4626	622

PROB.

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#### PROBLEM L

To find whether any given Year be Leap Year.

#### RULE.

Divide the given Year by 4, if o remains, it is Leap Year, but if 1, 2, 3 remains, it is so many Years after.

#### EXAMPLES.

1. Is 1779 Leap Year?

2. Is 1776 Leap Year?

Note, Every fourth Yearis Leap Year, so called from leaping or advancing a Day more that Year than any other; that Year has then 366 Days in it, and February 29.

#### PROBLEM II.

To find the Dominical Letter till the Year 1800.

#### RULE.

To the given Year add its fourth Part, omitting Fractions, divide that Sum by 7, the Remainder taken from 7 leaves the Index of the Letter in the common Year's Reckoning

# ABCDEFG

But in Leap Lears, this Letter and its proceeding one are the Dominical Letters.

## EXAMPLES.

- 3. For the Year 1779, I demand the Dominical Letter?
- 4 For the Year 1766, I demand the Dominical Letter?
  - 2. The Dominical Letter is that Letter of the Alphabet which points out in the Calendar the Sundays throughout the Year; thence also called the Sunday Letter; of these Letters are consequently seven before-mentioned, beginning with the first Letter of the Alphabet; and, as in Leap Year, there is an intercalary Day, there are then two, one serving January and February, and its sollowing Letter the remaining Part of the Year.

PROB-

#### PROBLEM M.

To know on what Day in the Week any proposed Day of the Month will fall.

#### R U L E.

First find the Dominical Letter, then the Day of the Week the first of the proposed Months fall on, which is known by the two following Lines:

At Dover dwells George Brown, Esquire, Good Christopher Finch, and David Frier.

Where the first Letter of each Word answers to the Letter belonging to the first Day of the Months in order, from January to December.

You must observe that the 1st, 8th, 15th, 2td, and 29th Day of any Month falls on the same Day of the Week.

#### EXAMPLES.

fall, it being Queen Charlotte's-Birth-Day?

6. On what Day of the Week does the 4th of June fall it 1776, being King George the Third's Birth Day?

#### PROBLEM IV.

To find the Year of the Solar, Lunar, or Golden Number, and Indiction Cycles.

#### Table Listering R. U.L. E.

To the given Year add o, for the Solar 1, for the Luna 3, for the Indiction divide the Sums in order by 28, 19 15, the Remainder in each shews the Year of its respective Cycle.

#### EXAMPLE.

7. Required the Year of the Solar, Lunar, and Indicate Cycles, for the Years 1779 and 1776?

4. The Solar Cycle, or the Cycle of the Sun, is a Perio of 28 Years; in which Time all the Varieties

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the Dominical Letters will have happened, and the 29th Year the Cycle begins again, when the same Order of the Letters will return as were 28 Years before.

At the Birth of Christ, nine Years had passed in this Cycle. The Lunar Cycle, or Cycle of the Moon, or Golden Number, is a Period of 19 Years, containing all the Variations of the Days on which the new and full Moons happen, after which Time they fall on the same Days they did 19 Years before, and she begins again with the Sun.

But when a Centissimal or Hundredth Year falls in the Cycle, the new and full Moon, according to the new Stile, will fall a Day later than otherwise. The Birth of Christ happened in the second Year of this Cycle.

The Roman Indiction is a Cycle of 15 Years, which first be-

# PROBLEM V. To find the Epact till the Year 1900.

# SW R U L E.

Multiply the Golden Number for the given Year by 11, divide that Product by 30, and from the Remainder take 11, leaves the Epact. If the Remainder is less than 11, and to it, and the Sum will be the Epact.

## EXAMPLES.

Find the Epact for the Year 1476.
Required the Epect for the Year 1779.

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J. The Epact of any Year is the Moon's Age, at the Beginning of that Year, that is, the Day's pall fince the last new Moon.

# PROBLEM VI. To find the Moon's Age.

#### RULE.

To the Epact add the Number and Day of the Monthtir Sum, if under 30, is the Moon's Age. But if that D d

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Where the first Letter of each Word answers to the Letter belonging to the first Day of the Months in order, from January to December.

You must observe that the 1st, 8th, 15th, 2:d, and 29th Day of any Month falls on the same Day of the Week.

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#### EXAMPLES.

5. In 1779 on what Day of the Week does the 19th of May fall, it being Queen Charlotte's-Birth-Day?

6. On what Day of the Week does the 4th of June fall in 1776, being King George the Third's Birth Day?

#### PROBLEM IV.

To find the Year of the Solar, Lunar, or Golden Number, and Indiation Cycles.

#### R. U.L.E.

To the given Year add 9, for the Solar 1, for the Luna 3, for the Indiction divide the Sums in order by 28, 19 15, the Remainder in each shews the Year of its respective Cycle.

#### EXAMPLE.

Required the Year of the Solar, Lunar, and Indiction Cycles, for the Years 1779 and 1776?

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#### EXAMPLES.

Find the Epact for the Year 1476.
Required the Epect for the Year 1779.

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5. The Epact of any Year is the Moon's Age, at the Beginning of that Year, that is, the Day's palt fince the last new Moon.

# PROBLEM VI. To find the Moon's Age.

#### RULE.

To the Epact add the Number and Day of the Monthheir Sum, I if under 30, is the Moon's Age. But if that D d Sum is greater, then 30 taken from it leaves the Moon's Age.

The Moon's Age taken from 30, leaves the Day of the

next Change.

When the Solar and Lunar Cycles begin together, the Moon's Age on the first of each Month, or the Month! Epacts, are called the Numbers of the Month, and are a follows, viz.

For Jan. Feb. Mar. April. May. June. These o. 2. 1. 2. 3. 4. For July. Aug. Sep. Oct. Nov. Decem. These 5. 6. 8. 8. 10. 10.

#### EXAMPLES.

10. Required the Moon's Age on May 21, 1776?

II. What is the Moon's Age on the 24th of March, 1779

6. The Moon's Age is how many Days are past find the Day of her Change, which Age never exceed 30 Days.

#### PROBLEM VII.

To find when Easter Day will happen.

#### RULE.

Find the Moon's Age (by the last Prob.) on the 21st March in common Years, or on the 20th in Leap Yea and if it be 14, find the Week Day, (by Prob. III.) and Sunday following is Easter-Day.

If the Moon's Age is not 14, reckon as many Days f ward as make 14, find the corresponding Week Day, a

the next Day following is Easter-Day.

#### EXAMPLES.

12: On what Day does Easter Sunday fall for the Y

13. Required the Time of Easter-Day for the Year 1779

7. Easter is the Time when Christians celebrated the furrection of Christ from the Grave, and took Rife from Eastra, the Name of the Saxon Deit Godd

To Moon

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Mace, The Water

or S. 1 N. 6. 1 Goddess, whose Festival was celebrated about this Time of the Year, and after its Abolishment by Christianity, the Name was retained, and is to this Day used to signify the Festival of Christ's Resurrection, as mentioned above.

#### PROBLEM VIII.

To find the Time of the Moon's Southing,

#### RULE.

Multiply the Moon's Age by 4, divide the Product by 5, quotes the Hours, and the Remainder, multiplied by 12, gives the additional Minutes.

If this Time is less than 12 Hours, it is the Time of southing after Mid-Day, but if greater, 12 Hours taken from it, leaves the Southing after Midnight.

#### EXAMPLES.

- 14. Required the Time of the Moon's Southing at London, on the 21st of May, 1776 F
- 15. At what Time does the Moon come to the Meridian at Bristol Key, on March 24, 1779?
  - 8. The Moon's Southing at any Place, is the Time when the comes to the Meridian, or is full South of that Place, which is every Day later by about 48 Minutes, occasioned by the Hours in a Day being divided by the 30 Times she passes the Meridian from new Moon to new Moon.

#### PROBLEM IX.

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To find the Time of High Water at any Place.

#### RULE.

To the Time of the Moon's Southing add the Time the Moon has passed the Meridian to make High Water at that hace, and the Sum will show the Time of High Water.

The Distance of the Moon from the Meridian when High Water at the following Places, is, at London, Deears N. E. & S. E. 3 h. oo m. Bristol Key Deears E. by S. and W. by & 6 h. 45 m.

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#### EXAMPLES.

16. On the 21st of May, 1766, at what Time is it High Water at London?

17. On the 24th of March, 1779, at what Time is it High.

Water at Briftol Key?

10. High Water is the State of the Tide when highest, or the Time it ceases to slow up.

#### QUESTIONS for Exercise at Leisure Hours.

1. England was conquered by William I, October 4, 1066, his Son, William II. came to the Crown Sept. 9, 1087, and left it August 2, 1100; William III, received it Feb. 3, 1689, and died March 8, 1701; how many Days did each of these Princes govern, Respect being had to the intercalary Days, and to February every Leap Year, as they rose in the Course of Time?

John his Brother succeeds him April 6, 1199; Richard II. succeeded Edward III. on the 21st of June, 137%, and was deposed by Henry IV. on the 30th of September, 1399; Richard III. caused his Nephew, Edward V. and his Brother, to be murdered, on the 18th of June, 1483, and was slain himself on the 22d of August, 1485: How many Days was the Realm governed by the three Richards, Respect being still had to the inter-

calary Days as they happened?

3. The first Queen Mary came to the Crown July 8, 1553; she reigned & Years, 4 Months, and 9 Days; her sister Elizabeth succeeded, and James I. came to the Throne the 14th of March, 1682, who lest it to his Son, Charles I. on the 27th of March, 1625, who was forced from it January 30, 1648: The Question is, how many Days did these Princes reign, and at the Death of Charles I. how long had England been under an interrupted Succession of Protestant Princes, Many the First being the last professed Papist that enjoyed the Crown, not neglecting the intercalary Days in February as before?

7:

4. A Grant was made Feb. 14, in the 10th of Henry I. who began his Reign August 2, 1100; it was resumed Nov. 19, in the 4th of Henry III. who came to the Crown October 19, 1216; it was received the 16th Day of July, in the 13th of Henry VII. who ascended the Throne August 22, 1485; but it was a second Time revoked and finally suppressed, in the 16th of his Successor, Henry VIII. on the 10th of May: Now as this Man's Father died July 21, 1509, the Question is, how many Days was this Grant in Force, and how many did it lie dormant?

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EXAMPLES on the TERRESTIAL GLOSE, or MAPS.

r. What is the Latitude and Longitude of Peking, in China, and Cape Horn?

2. Required the Name of that Place whose Latitude is 18°.

N. and Longitude 76½ W. also of another Place, whose Latitude is 34½ S. and Longitude 16½ E.

3. What is the Difference of Latitude between London and Naples; also between the Island of Barbadoes, and Cape of Good Hope?

4. Required the Distance (in English Miles) Jamaica is from London; also the Names of all those Places that are at the same Distance from London as Rome is?

5. Required the Sun's Declination, right Afcention, and Meridian Altitude, on the 20th of May?

6. Required the Time of the Sun's rifing and fetting, on the 20th of May; also its Amplitude at the same Time? likewise when the Twilight begins and Ends?

7. What is the Sun's Azimuth and Altitude, on the 20th of May, at 4 o'Clock in the Afternoon?

What is the Angle of Position, or Bearing of Port-Royal in Jamaica, from London; and on the contrary, London from Port-Royal?

9 When it is Noon, or Twelve o'Clock, at London, what o'Clock is it at Peking in China; also at what Places are they breakfassing, dining, and supping, suppose D d 3.

they breakfast at 7 o'Clock, dine at 1, and sup at 2 Quarter after 9?

10. What Places are those to which the Sun is vertical on

the 2d of May?

11. On what two Days in the Year will the Sun be vertical

to Candy, in the Isle of Ceylon?

12. What Places are those in the North Frigid Zone, to which the Sun begins to shine constantly, without setting, on the 20th of May?

13. On what Day doth the Sun begin to shine constantly, without setting, at the Cherry Island, whose Lat. is 74°

North; and how long?

14. What Places are those to which the Sun is rising, setting, or in the Meridian; also those Places which are enlightened, and those which are not, on the 20th of May, at 8 in the Morning?

happen an Eclipse of the Sun; I demand to know, to what Part of the Globe the same will be visible?

12

13

4.

16. On the 3d of June, 1769, in the Afternoon, happened a Transit of Venus over the Sun; the Beginning of this Transit was at 7 h. 13 m. Middle 10 h. 35 m. End 1. h. 55 m. I demand to know where the Beginning, Middle, and End thereof, was visible?

17. In what Latitude is the longest Day 20 Hours long?

18. What Inhabitants of the Earth are those called Antoeci, Perioeci, and Antipodes, with respect to London?

#### EXAMPLES on the CELESTIAL GLOBE.

1. Required the Time of the Sun's rising and setting; also, the Beginning and End of the Crepusculum, or Twilight, on the 21st of June?

2. What is the Moon's diurnal Motion in Ecliptic; also, at what Time doth the rife, set, and come to the Meri-

dian, on the 20th of May, 1774?

3. Required the Latitude of the Moon, and her Declination, on the 20th of May, 1774?

4. At what Time doth the Planet Jupiter rise, culminate, and set, on the 20th of May, 1774; also, what its right Ascension,

Ascension, Declination, Amplitude, and Azimuth, on the above Day?

g. What is the right Ascension, Declination, Latitude, and

Longitude of Pollux?

6. What Star is that whose right Ascension is 65° 30", and its Declination 12° 15' 30" North; also what Time doth it rise, come to the Meridian, set, and what is its Amplitude on the 20th of July, in the Lat. of London?

7. On what Days of the Year will the Star Arcturus rise and

fet cosmically, at London?

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8. Required the Time when Procyon and Canis Minor will rise and set acronically, at London?

9. On what Day in the Year will Altayr culminate, or come

to the Meridian with the Sun?

10. At what Time of the Year will the Pleiades, or Seven Stars, be upon the Meridian at Midnight?

What is the oblique Ascension of Sirius, and what is the Time of its Continuance above the Horizon of London?

12. What is the Altitude and Azimuth of Capella, on the 20th of May, at 10 o'Clock at Night, in the Latitude of London?

3. The Altitude of Cor Leonis, on the 22d of May, at London was 20, required the Hour of the Night?

4. A Person being in a certain Place, on the 20th of May, at 4 after 3 in the Morning, observed the Pleiades was then rising; required the Latitude of the Place of Observation?

Stars, Lucida Lyræ, and Altyar, will both be on the

fame Azimuth; required the Hour of the Night?

M. On the 11th of May (Lat. as before) the bright Star Markeb in Pegasus's Wing, and that in the Head of Andromeda, will both have an equal Altitude, required the Hour?

A Person being at Sea, sound, by Observation, that Sirius was then upon the Meridian, and Arcturus rising;

required the Lat. of the Place of Observation?

Another Person being at a certain Place, sound, by Observation, Cor Hydræ and Procyon are both on the Azimuth of 78° 45' S. E. one with 5° of Altitude,

and

and the other with 35°; required the Latitude of the Place of Observation?

19. To what Latitude, South, must I travel, to lose Sight of the Star Capella?

20. Represent the Face of the Heavens on the Globe, on

the 20th of May, at 10 at Night?

21. By an Observation made at Jamaica of a Comet, on the 31st of March, 1759, at 5 o'Clock in the Morning, its Altitude was found to be 22° 50' and Azimuth 71° South East; another Observation was made at London on the 6th of May, 1759, at 10 at Night of the same Comet, and then its Altitude was found to be 16° and its Azimuth 37° S. W. It is required to know the Place of the Comet at each Observation?

and setting, at London, on the 31st of March, 1759; also its Latitude, Longitude, Declination, and Ascent

fion !

23. Required the apparent Path among the fixed Stars in the Heavens, of the above Comet, also its Velocity

Note, These Problems are answered by Mr. Hill's Twelve-Inch Globes.

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## TUTOR'S GUIDE.

#### PART.V.

# 78. ALGEBRA.

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A LGEBRA is a Kind of specious Arithmetic, or an Arithmetic in Letters; and is that Science which teaches in a general Manner, the Comparison of abstract Quantities; by Means whereof such Questions are resolved whose Solutions would be sought in vain from common Arithmetic.

Here every Quantity, whether given or required, is commonly represented by some Letter of the Alphabet; the known or given Quantities, for Distinction Sake, being noted by the first Letters, a, b, c, d, &c, and the unknown Ones by the last Letters, x, y, z, &c.

There are, moreover, in Algebra, certain Signs or Notes, made Use of, to shew the Relation and Dependence of Quantities one upon another, whose Signification the Learner ought first of all to be made acquainted with. (See the Characters for Abbreviation next before Page 1.

### 79. A D D I T I O N.

In Addition of Algebraic Quantities, there are three Cafes, as follows:

#### CASE I.

To add Quantities that are alike, and have like Signs.

### RULE.

Add together the Co-efficients, to their Sum, prefix the common Sign, and subjoin the common Letter or Letters.

### EXAMPLES.

To 6a-4b 6a+7b-3c ab-6b+4x+10y-15z+6. Add a-3b 10d+b-7c 6ab-b+x+4y-9z+3.

Sum 7a-76

#### CASE II.

To add Quantities that are alike, but have unlike Signs,

#### R. U.L. EA. . O.

Subtract the leffer Co-efficient from the greater, to the Remainder prefix the Sign of the greater, and subjoin the common Letter or Letters.

### EXAMPLES.

To -6a-4b-6c -6b-7c-8x 6a-6x+77-10Add +9a 2-69c +4b+9c+5x -6a+6x-47+13

Sumait 34 in non no nevig todische etingan O entre erell

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To add Quantities that are unlike.

### R U L E. Jal and to and

Set them all down one after another, with their Signand Co-efficient prefixed.

### trattal and notine X A M.P. L. E.S. none and and

Add 4x+4 35-47 3-4x-79+4x 6x410

Sum 6a-3b+4x+4

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### 80. SUBTRACTION.

Subtraction of Algebraic Quantities is performed by the following general

### RULE.

Change the Signs of the Quantity to be subtracted into their contrary Signs, and then add it so changed to the Quantity from which it was to be subtracted, (by the Rule of Addition) the Sum arising will be the Remainder.

### EXAMPLES.

From 
$$6a-7b+3c$$
  $3a$   $2a-4x+7y-7$   $6b-4c+4x$ .

Take  $-3a-b+6c$   $-3a$   $6a+4x+7y+4$   $7b+7c-9x$ .

Rem.  $9a-6b-3c$ 

### 81. MULTIPLICATION.

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In Multiplication there is one general Rule for the Signs, iz. When the Signs of the Bactors are alike, that is, both t, or both —, the Sign of the Product is more, but when the signs of the Factors are unlike, the Sign of the Product is —. This general Rule will resolve itself into three particular sales, as follows:

### CASE I.

When the Quantities have like Signs, and no Efficients, at or join them together, and prefix the Sign + before m will be their Product.

### EXAMPLES.

	Security are at the page		The second of the second
Mul. a+6	_a a+c.	_a_b_c	x+y+z.
By d	-6 6	<u></u> d	a
			*****
- ad+			Ag
24+0		and the later and a significant	1

CASE

### CASE II.

If there be Co-efficients, multiply them, and to their Product adjoin the Quantities fet together as before.

	EX	A M	PLE	S.
Mul.	64+36	—8 <i>x</i>	34+76	12x+69
By	3¢	44	56	44
Prod. 1	8ac+9bc	A of erre	W. A. C.	out the

#### CASE III.

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When the Quantities have unlike Signs, join them and the Product of the Co-efficient together as before, but prefit the Sign—before them.

4xcy+s
4×5y+x
MCCharty stratilaness

When the Multiplier confists of several Terms, you mu multiply every Part of the Multiplicand by each Part of th Multiplier, then add all the Products into one Sum, whice will be the Product required.

Mal. By	E X 2a-3b 4a+5b		P L E 2-48 4+26	S. aa+ab a—b	
Pród.		-1566 M		255,245,440,128-0382 TEMPERSON STATE	
Mul By	1. xx+xy- xx-xy-			ab + 3ab-	-666
Pro	a		de antique de la constitución de	- And Co. 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	I

#### 82. D I V I S I O N.

Division of Algebra Quantities is the direct Contrary to that of Multiplication, and consequently performed by direct contrary Operations; it admits of four Cases.

## CASE I.

When the Quantities in the Dividend have like Signs to those in the Divisor, and no Co-efficient in either, cast off all the Quantities in the Dividend, that are like those in the Divisor, and set down the other Quantities with the sign + for the Quotient.

### EXAMPLES.

livisor. Dividend

aid

a) ab (b, Quot. d) ad +6d( -d) -ad -bd( a) aa + ab(

#### CASE II.

When the Quantities in the Dividend have unlike Signs those in the Divisor, then set down the Quotient Quantitions found as before, with the Sign — before them.

### EXAMPLES.

-a)ab( -+b)-ab-bd( -bc)abc+bcd+bcf(

### CASE III.

If the Quantities in the Dividend and the Divisor have efficients, divide as in Sect V. and join to their Quantities.

### EXAMPLES.

6a) 24ab (4b 7b) 42db ( 2bx) 8abx-18bx(

### in Red ice a-1 - to aving a & Sload .

When the Quantities in the Divisor cannot be exactly ad in the Dividend, then set them both down like a Vul-Fraction, as in common Arithmetic, and expunge any ters that may be found in all the Quantitics of the Diviland Divisor, and divide the Co-efficients of all the ms by any common Measure.

E e

#### MEXAMPLES.

50+74)5d+4b(50-7a, 2b)ab+bb( 20a)10ab+15ac(

If the Quantity to be divided is compound, then you mul range its Parts according to the Dimensions of some one of its Letters as in the following

a+b) aa+2ab+bb( a+b) aa-bb( 3a-6)  $4a^4-6$ 1-a)  $1(3x^2-4x+5)$   $18x^4-45x^3+82x^2-67x+40$ ( 4z-5a)  $48x^3$   $76ax^2-64a^2x+105a^3$ ( 3x+4a)  $81x^4-256a^4$ ( 1+x) 1(2x-3a)  $16x^4-72a^2x^2+81a^4$ (

### 83. FRACTIONS.

Algebraic Fractions are of the fame Nature, and requithe fame Management as those of Numbers.

A mixt Quantity is reduced to an improper Fraction the Rules in Sect 38. Case 3.

1. Reduce  $a + \frac{aa}{b}$  to an improper Fraction.

z. Reduce  $a = x + \frac{1}{x}$ , to an improper Fraction.

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- 3. Reduce  $a+b+\frac{x}{2}$  to an improper Fraction.
- 4. Reduce  $a-x+\frac{aa-ax}{x}$  to an improper Fraction.

An improper Fraction is reduced to a mixt Quantity, by the Rule in Sect. 38, Case 4.

### EXAMPLES.

5. Reduce  $\frac{ba+aa}{b}$  to a mixt Quantity.

Thus, 
$$\frac{ab-a^2}{b} = a + \frac{a^2}{b}$$

6. Reduce  $\frac{a^2-x^2}{x}$  to a mixt Quantity.

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- 7. Reduce  $\frac{az+bz+x}{z}$  to a mixt Quantity.
- 8. Reduce  $\frac{ax-xx+aa-ax}{x}$  to a mixt Quantity.

Fractions of different Denominations are reduced to Fractions of equal Value, and to have the same Denominator by the Rule in Sect. 38, Case 5.

### EXAMPLES.

9. Reduce  $\frac{a}{b}$ , and  $\frac{c}{d}$ , to a common Denominator.

Thus, 
$$\begin{cases} a \times c \times d = acd \\ b \times b \times d = bbd \\ c \times b \times c = bcc \end{cases}$$
 N. N. So  $\frac{a}{b}$ ,  $\frac{c}{c}$ ,  $\frac{c}{a}$ , become

10. Reduce  $\frac{a}{b}$ ,  $\frac{c}{d}$ ,  $\frac{e}{f}$ , to a common Denominator.

11. Reduce  $\frac{b+c}{a+b}$  and  $\frac{d-c}{b-d}$  into one Denomination.

Fractional Quantities are reduced into their lowest Terms by the Rule in Sect. 38, Case 1.

### EXAMPLES.

12. Reduce  $\frac{a^2c-a^2d}{cd-d^2}$  to its lowest Terms.

Thus,  $cd-dc^2$ )  $a^2c-a^2d$  (aa,  $a^2c-a^2d$  the Fraction required.

13. Reduce \(\frac{aaa-abb}{aa+2ab+bb}\) to its lowest Terms,

14. Reduce  $\frac{25az}{5xz+15az}$ , and  $\frac{aaa+bbb}{aa-bb}$ , to their lowest

The Rules for Addition, Subtraction, Multiplication, and Division of Algebraic Fractions, are the same as for Numerical Fractions; see Sect. 39, 40, 41, and 42.

### EXAMPLES in ADDITION.

1. Add a to find reduce them to a common Denominator

and they will become ad + be ad+be the Sum required.

2. Add  $\frac{a}{b} + \frac{c}{d} + \frac{d}{c}$  into one Sum.

3. Add a-b+d, and a+b-d together.

4. Add  $\frac{2a-b}{k+c}$ , and  $\frac{2b-a}{a+c}$  together.

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4. Add 
$$\frac{a+b}{d}$$
 to  $\frac{2a+c}{d}$ 

## EXAMPLES in SUBTRACTION.

1. From 
$$\frac{a}{b}$$
 take  $\frac{c}{d}$  Thus reduced,  $\frac{ad}{bd}$   $\frac{bc}{bd}$   $\frac{ad-bc}{bd}$ 

2. From 
$$\frac{x}{2}$$
 take  $\frac{x}{3}$  3. From  $\frac{a+x}{b}$  take  $\frac{a-x}{b}$ 

4. From 
$$\frac{bb+aa}{c}$$
 take  $\frac{bb}{c}$  5. From  $\frac{2b}{d+d}$  take  $\frac{a+b-d}{d+d}$ 

### EXAMPLES in MULTIPLICATION.

I. Mul. 
$$\frac{a}{b}$$
 by  $\frac{c}{d}$  Thus,  $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$  the Product.

2. Mul. 
$$\frac{a+b}{c}$$
 by  $\frac{a-b}{d}$  3. Mul.  $a+\frac{b}{c}$  by  $\frac{d}{d}$ 

4 Mul. 
$$\frac{3a-2b}{2d+c}$$
 by  $\frac{4a+2b}{d}$ 

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§ Mul. 
$$2a + \frac{\delta}{6} - 25$$
 by  $36 + 4c$ .

### EXAMPLES in DIVISION.

1. Divide 
$$\frac{a}{b}$$
 by  $\frac{c}{d}$  Thus,  $\frac{a}{b} \cdot \frac{c}{d} = \frac{ad}{bc}$  the Quotient.

Divide 
$$\frac{acd+bd}{cd}$$
 by  $\frac{d}{a}$  3. Divide  $\frac{a-b}{a}$  by  $\frac{a+b}{a-b}$ 

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4. Divide 
$$a + \frac{b}{c}$$
 by  $d + \frac{e}{f}$  5. Divide  $\frac{ab}{c}$  by  $\frac{1}{c}$ 

### 84. Of S U R D S.

Surds are such Numbers as cannot be exactly expressed in Figures, and are called irrational Numbers.

### ADDITION and SUBTRACTION.

1. When the Surd Quantities are Homogeneal, i. e. alike, add or subtract the rational Part if they are joined to any, and to their Sums or Difference adjoin the Irrational or Surd.

### EXAMPLES in ADDITION.

				b+3 Vaa-00
Add	7 V 0x	4Vab		b-3√aa-cc
Sum	13 V bx			

### EXAMPLES in SUBTRACTION.

From	174 bx	10a/bc	6b Vaa+xx	8-t-a
Take	10 V bx	6aVbc	46 Vaa+xx	a-Vic-aa
Diff.	746x		<del></del>	

2. If the Surd be Heterogeneal, i. e. unlike, add or subtract according to the Signs.

### EXAMPLES in ADDITION.

Bum Vab:+Vad		· —

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### EXAMPLES in SUBTRACTION.

From bz a-b  $\sqrt{cc+dc}$   $\sqrt{bc}$ Take  $\sqrt{bz}$   $b-2c\sqrt{ab+bb}$   $\sqrt{ba}$ Rem.  $\sqrt{bz-az}$ 

MULTIPLICATION.

1. When the Quantities are pure Surds of the same Kind, multiply them together, and to the Product prefix their radicial Sign.

EXAMPLES.

Mul.  $\sqrt{a}$   $\sqrt{bc+dc}$   $\sqrt{xx+zz}$  By  $\sqrt{b}$   $\sqrt{ac}$   $\sqrt{xx-zz}$  Prod.  $\sqrt{ab}$ 

2. If rational Quantities be joined to the Surds, then multiply the Rational into the Rational, and the Surd into the Surd, and join the Product together.

EXAMPLES.

Mul.  $a\sqrt{bx}$  6cd $\sqrt{b}$ +da 15 $\sqrt{az}$ By  $4b\sqrt{d}$  3a $\sqrt{ca}$  5 $\sqrt{x}$ Prod.  $4ab\sqrt{dbx}$ 

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DIVISION.

1. When the Quantities are pure Surds of the same Kind, and can be divided off, (viz. without leaving a Remainder) divide them, and to their Quotient prefix their radical Sign.

### EXAMPLES.

Divide vab	V bixxx + acxx	Vzzzz-xxx
By ✓b	√cx	$\sqrt{zz-xx}$
Quotient va		And the second s

2. If Surd Quantities of the same Kind are joined to rational Quantities, then divide the Rational by the Rational, if it can be, and to their Quotient join the Quotient of the Surd, divided by the Surd, with its sirft radical Sign.

#### EXAMPLES.

Divide	$4xy\sqrt{xzn}$	$14xya\sqrt{y}xx + axx$	6ab V 10acxy
Ву	2x 1/2	7 x y x x	20 V 2cy
Quot.	2y √ xn		E V VII

Note, Different Powers or Roots of the same Quantity are divided, by subtracting the Expoient of the Divisor from that of the Dividend, and place the Remainder as an Expoient to the Quantity given.

Thus  $x^3$  divided by  $x^2$ , gives  $x^3$ : And  $a+x|^7$  divided by  $a+x|^4$  gives  $a+x|^3$ : Likewise  $x^{\frac{1}{2}}$  divided by  $x^{\frac{1}{4}}$  gives  $x^{\frac{1}{4}}$ , &c.

### 86. INVOLUTION.

Involution is the raising of any given Quantity to any proposed Power.

1. If the Quantity proposed to be involved has no Index, that is, if it be not itself a Power or a Surd, the Power thereof will be represented by the same Quantity under the given Index or Expoient.

Thus, the Cube or third Power of x, is expressed x1.

And the fixth Power, a+z, by a+z,6, &c.

- 2. But if the Quantity proposed be itself a Power or Surd, it will be involved by multiplying its Expoients by the Expoient of the proposed Power.
- Thus, the fifth Power of  $x^2$  is  $x^{10}$ , the fourth Power of  $ax+y^{13}$  is  $ax+yy^{112}$  and the third Power of  $a-x\frac{1}{2}$ , is  $a-x\frac{1}{2}$ .
- 3. A Quantity composed of feveral Factors, multiplied together, is involved by raising each Factor to the Power proposed.
- Thus, the Square or fecond Power of ax is  $a^2 x^2$ , the Cube or third Power of 2ax is  $8a^3 x^3$ ; the fourth Power of  $4 \times aa xx$ ,  $\times a + b + c$  is  $16 \times aa xx^{14} \times a + b + c^{14}$ , and the Square of the radical Quantity  $a^{\frac{1}{2}} \times a + x^{\frac{1}{3}}$  is  $a \times a + x^{\frac{1}{3}}$ .
- 4. A Fraction is involved by raifing both the Numerator and the Denominator to the Power proposed.
- Thus, the Cube or third Power of  $\frac{a}{b}$  is  $\frac{aaa}{bbb}$ , and the fourth
  - Power of  $\frac{2a^2x}{3b^2}$  is  $\frac{8a^8x4}{81^9}$ ; likewise the fixth Power of  $\frac{aa+xx^{\frac{1}{2}}}{a-x^{\frac{1}{3}}}$  is  $\frac{aa-x^{\frac{1}{3}}}{a-x^{\frac{1}{2}}}$
- 5. Quantities compounded of several Terms, are involved by a continual Multiplication of all their Parts.
- Thus, a+b involved to the Square or fecond Power, is

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aa + 2ab + b Square or second Power.

### EXAMPLES.

- 1. Involve or raise x to the fourth Power:
- 2. Raile ax+z|2 to the fifth Power.
- 3. Involve 3x322 to the third Power.
- 4. Involve  $\frac{\epsilon ab}{2c}$  to the fixth Power.
- 5. Involve or raise x+y the fixth Power, this is called a Binomial Root.
- 6. Involve or raise x-y the fixth Power, this is called a Residual Root.

There is a Rule or Theorem, given by Sir faac Newton, whereby any Power of a Binominal, or x—y, may be expressed in simple Terms, without the Trouble of those tedious Multiplications which are required otherwise.

Theo. 
$$J \times \frac{m-6}{1} \times \frac{m-1}{2} \times \frac{m-2}{3} \times \frac{m-3}{4} \times \frac{m-4}{5} \times \frac{m-5}{6} \times$$
, &c.

Note, m is the Expoient of the Power, that is, m=7, in the feventh Power, 6, in the fixth Power, &c.

So that if x-y is to be raised to any Power m, the Terms, without their Co efficients, will be

$$x^{m}, x^{m-1}, x^{m-2}, x^{m-3}, x^{m-4}, x^{m-5}, x^{m-6}, x^{m-6}, x^{m-6}$$

&c. continued till the Expoient of y becomes equal to m.

And the Co-Efficients of the respective Terms will be

1, m, 
$$m \times \frac{m-1}{2}$$
,  $m \times \frac{m-1}{2} \times \frac{m-2}{3}$ ,  $m \times \frac{m-1}{2} \times \frac{m-2}{3} \times \frac{m-3}{4}$ 

$$m \times \frac{m-1}{2} \times \frac{m-2}{3} \times \frac{m-3}{4} \times \frac{m-4}{5}, m \times \frac{m-1}{2} \times \frac{m-2}{3} \times \frac{m-3}{4} \times$$

$$\frac{m-4}{5} \times \frac{m-5}{6} \times x^{m-6}$$
, 6+, &c.

So by this Theorem any Quantity, confissing of two Terms, is raised to any Power m, with great Ease and Perspicuity, and will be of great Service to the young Algebraist, if properly demonstrated to him by his Tutor.

the methods of the host required.

## 87. E V O L U T I O N.

Evolution, or the Extraction of Roots, being directly the Contrary to Involution, or raising of Powers, is performed by converse Operations, viz. by the Division of Indices, as Involution was by their Multiplication.

Thus, the square Root of  $x^6$ , is  $x^3$  the Cube Root  $x^6$  is  $x^2$ , also the Biquadratic Root of  $x+y^{\frac{1}{2}}$ , will be  $x-y^{\frac{1}{2}}$ ; and the Cube Root of  $xx+y^{\frac{1}{2}}$  will be  $xx-y^{\frac{1}{2}}$ . Moreover the square Root of  $xx-y^{\frac{1}{2}}$  will be  $xx-y^{\frac{1}{2}}$  its Cube Root  $xx-yy^{\frac{1}{2}}$ , and its Biquadratic Root  $xx-yy^{\frac{1}{2}}$ , and so of others.

Evolution of Compound Quantities is performed by the following

### R U L E.

First, place the several Terms, whereof the given Quantity is composed, in order, according to the Dimensions of some Letter therein, as shall be judged most commodious; then let the Root of the first Term be found, and placed in the Quotient, which Term being fubrracted, let the firft Term of the Remainder be brought down, and divided by twice the first Term of the Quotient, or by three Times its Square, or four Times its Cube, &c. according as the Root tobe extracted is a Square, Cubic, or Biquadratic One, &c. and let the Quantity thence arising be also wrote down upon the Quotient; and the Whole be raised to second, third, or fourth, &c. Power, according to the aforesaid Cases, respectively, and subtracted from the given Quantity, and if any Thing remains, let the Operation be repeated, by always dividing the first Term of the Remainder by the same Divisor, found as above.

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### EXAMPLES.

1. It is required to extract the Equare Root of x2 + 2x+y2?

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Thus,  $x^2 + 2xy + y^2$  (x + y the Root required. 2x(2xy) $x^2 + 2xy + y^2$  fecond Power of x + y.

> Or thus, by Sect. 53.  $x^2 + 2xy + y^2(x + y)$  Root as before.

 $2x+y)2xy+y^2$   $2xy+y^2$ 

2. It is required to extract the square Root of  $x^2-2\lambda y$ 

3. It is required to extract the square Root of  $x^4-2x^3y-3x^2y^2-2x^3y-3y^4$ ?

4. Extract the Cube Root of x3 -6x2y 12x2y 8y3.

5. Extract the Biquadratic Root of  $16x^4 - 96x^3y - 216x^2y^2 - 216xy^3 - 81y^4$ .

### 88. INVOLUTION of SURD QUANTITIES.

1. When the Surds are not joined to radical Quantities, they are involved to the same Height as their Index denotes, by taking away their radical Sign.

Thus,  $\sqrt{xx}$  will be x, and  $\sqrt{xx-1}$  yy will be  $x^2-1$  y<sup>2</sup>, &c.

2. When Surds are joined to rational Quantities, involve the rational Quantities to the same Height as the Index of the Surd denotes; then multiply the involved Quantities into the Surd Quantities, after the radical Sign is taken away, as before.

Thus, x = yy, will be  $x^2y^2$ , and 4x = yy, will become  $16x^4 + 16x^2y^2$ , likewife  $2x: \sqrt[3]{x-y^2}$ , will become  $8x^5 + 8x^3y^2$ , &c.

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### 89. EQUATIONS.

An Equation is, when two equal Quantities, differently expressed, are compared together, by Means of the Sign = placed between them.

### REDUCTION of SINGLE EQUATIONS.

#### RULES.

1. Any Term of an Equation may be transposed to the contrary Side, if its Sign be changed.

Thus, x-12=20, then will x=20-12=8.

- 2. If there is any Quantity by which all the Terms of an Equation are multiplied, let them all be divided by that Quantity, but, if all of them be divided by any Quantity, let the common Divisor be cast away.
- Thus,  $a_x = ab$ , then will x = b; also, if  $\frac{x}{b} = \frac{a}{b}$ , x = a, by the latter Part of the Rule.
- is If there are irreducible Fractions, let the whole Equation be multiplied by the Product of all their Denominators, or, which is the same, let the Numerator of every Term in the Equation be multiplied by all the Denominators except its own, supposing such Terms (if any there be) that stand without a Denominator, to have an Unit subscribed.
- Thus  $x + \frac{x}{2} + \frac{x}{3} = 11$ , reduced is 6x + 3x + 2x = 66, or  $x = \frac{1}{3}$

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- 16 per Rule 5. Again,  $\frac{2x}{3}$  = 12= $\frac{4x}{5}$  = 6, this reduced will
  - become 10x 180=12x 90; then per Rule 1, x=45.
- 4 If in your Equation there is an irreducible Surd, wherein the unknown Quantity enters, let all the other Terms be transposed to the contrary Side, (by Rule I.) and then if both Sides be involved to the Power denominated by the Surd, an Equation will arise free from ra-

dical Quantities, unless there happen to be more Surds than one, in which Case the Operation is to be repeated.

- Thus,  $\sqrt{x-4}=12$ , by Transposition becomes  $\sqrt{x-12-4}=8$ ; which, by squaring both Sides, gives x=64.
- So, likewise,  $\sqrt{aa}$  xx-c=b, becomes  $\sqrt{aa}$  xx=b-c, squared, gives aa-xx=bb-2cb-cc, then per Rule 1,  $x^2=a^2-b^2-c^2$ , and  $x=\sqrt{a^2-b^2-2bc-c^2}$ .
- 5. Having, by the preceding Rules, (if there is Occasion) cleared your Equation of fractional and radical Quantities, and so ordered it, by Transposition, that all the Terms, wherein the known Quantities are sound, may stand on the same Side thereof, let the Whole be divided by the Co-efficients, or the Sum of the Co-efficients of the highest Power of the said unknown Quantity.

Thus, if 6x=24, then will  $x=\frac{24}{6}=4$ ; and if 4x=48-2x,

then will 6x=48, per Rule 1, and  $x=\frac{48}{6}=8$ .

#### EXAMPLES.

For the Learner's Exercise in the aforegoing Rules, set

- 1. If 20-3x-8=60-7x, what is the Value of x? Anf. 12.
- 2. When 5x-16=3x-12, what is x? Anf. 14.
- 3. If  $\frac{3x}{4} + 5 = \frac{5x}{6} + 2$ , what is x equal to? Anf. 36.
- 4. If  $\frac{7x}{8} 5 = \frac{9x}{10} 8$ , what is x? Anf. 120.
- 5. When  $\frac{5x}{9} 8 = 74 \frac{7x}{12}$ , quere x? Anf. 78.

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- 6. If  $56 \frac{3x}{4} = 48 \frac{5x}{8}$ , what is the Value of x? Anf. 64.
- 7. Required the Value of x, when  $36-\frac{4x}{9}=8$ ? Anf. 63.
- 8. When  $\frac{2x}{3} = \frac{176 4x}{5}$ , quere x? Anf. 24.
- 9. If  $\frac{45}{2x-3} = \frac{57}{4x-5}$  what is the Value of x? Anf. 6.
- 10. If  $\frac{4^2}{x-2} = \frac{35x}{x-3}$ , what is x equal to? Anf. 8.
- FI. If  $\frac{xx-12}{3} = \frac{xx-4}{4}$ , what is x equal to? Anf. 6.
- 12. When  $\frac{5xx}{16} = 8 \frac{1}{12}$ , what is the Value of x? Anf. 8.
- 13. Suppose  $\frac{x-1}{2} + \frac{x+2}{2} = 15 \frac{x+3}{4}$ , quere x? Ans. 13.
- 14. Suppose  $ax b^2 = \frac{ax^2 ac^2}{a x}$ , quere x? Ans.  $\frac{ac^2 ab^2}{a^2 b^2}$ .
- 15. If  $\frac{5x}{3}$  | 12=17, what is x? Anf. 45.

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- 16. What is the Value of x, when  $\sqrt{12-x}=2-\sqrt{x}$ ?
  Anf. 4.
- 17. If  $\sqrt{x} + \sqrt{a+x} = \sqrt{\frac{2a}{a+x}}$ , what is x? Anf.  $\frac{a}{3}$
- 18. Suppose 615x-7xxx=48x, quere x? Ans. 9.
- 19. Suppose  $\sqrt{a^2-1}x^2=4$ , what is x equal to?

  Ans.  $\frac{b^4}{a^2}-a^2$ .

Of the EXTERMINATION of UNKNOWN QUANTITIES, or, the REDUCTION of two or more EQUATIONS to a fingle One.

#### RULE.

1. Observe which of all your unknown Quantities is the least involved, and let the Value of that Quantity be found in each Equation, (by the Rules already given) looking upon all the rest as known; let the Values thus found be put equal to each other, (for they are equal) because they all express the same Thing; whence new Equations will arise, out of which that Quantity will be totally excluded, with which new Equations the Operations may be repeated, and the unknown Quantities extirminated, one by one, till at last you come to an Equation containing only one unknown Quantity.

Thus, Let the given Equations be x + y = 12, and 5x + 3y = 50, to find x and y.

Now by transposing y and 3y we get x=12-y, and 5x=50—3y, from the last of which Equation,  $x=\frac{50-3y}{5}$ 

Now by equating these two Values of x, we have  $12-y=\frac{50-3y}{5}$ , and therefore 60-5y=50-3y, from which, y is given  $=\frac{2}{10}=5$ , and x=12-y=12-5=7.

would first exterminate, be found in that Equation wherein it is the least involved, considering all the other Quantities as known; and let this Value and its Powers be substituted for that Quantity and its respective Powers in the other Equation, and with the new Equations thus arising, repeat the Operation, till you have only one unknown Quantity and one Equation.

Thus,

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- Thus, x being the first Equation, (in the last Example)

  =12-y, then by substituting this Value of x, in the fecond, that is 60-5y, must be wrote in the Room of its Equal 5x; whence will be had, 6-5y=3y=50; and from hence y=\frac{10}{2}=5, as before.
- 3. Or, lastly, let the given Equations be multiplied or divided by such Numbers or Quantities, whether known or unknown, that the Term which involves the highest Power of the unknown Quantity to be exterminated, may be the same in each Equation, and then, by adding, or subtracting the Equations, as Occasion shall require, that Term shall vanish, and a new Equation emerge, wherein the Number of Dimensions, (if not the Number of unknown Quantities) will be diminished.

By multiplying the first Equation by 5, we shall have 5x 5y=60 from whence subtracting the 2d Equation, viz. 5x 3y=50 there remains 2y=10

whence = 5, and \* by the first or second Equation will be 7, still the same as before.

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The first of these three Ways is the most commonly used, but the last of them is, for the general Part, the most easy and expeditious in Practice.

#### EXAMPLES.

1. Let 
$$\begin{cases} 5x - 8y = 106 \\ 4x - 5y = 5 \end{cases}$$
 quere the Value of  $x$  and  $y$ .  
2. Let  $\begin{cases} 5x - 3y = 150 \\ 10x - 15y = 825 \end{cases}$  quere  $x$  and  $y$ .  

$$\begin{cases} \frac{x}{2} + \frac{y}{3} + \frac{z}{4} = 62 \end{cases}$$

3. Let 
$$\begin{cases} \frac{2}{3} + \frac{y}{4} + \frac{z}{5} = 47 \\ \frac{x}{4} + \frac{y}{5} + \frac{z}{6} = 38 \end{cases}$$
 quere  $z$ ,  $y$ , and  $z$ .
Anf. 24, 60, and 120.

F. f 3

4. Let 
$$\left\{ \frac{x}{4} + \frac{y}{5} = 15 \right\}$$
 quere x and y. Anf. 24 and 45.

5. Given 
$$\begin{cases} \frac{x}{2} - 12 = \frac{y}{4} + \frac{1}{8} \\ \frac{x + y}{5} + \frac{x}{3} - 8 = \frac{2y - x}{4} + 27 \end{cases}$$
 what is the Value of x and y? Anf. 60 and 40.

6. Given 
$$\begin{cases} x+y=80 \\ x+z=70 \\ y+z=60 \end{cases}$$
 to find x, y, and z. Anf. 45, 35, and 25.

7. Suppose 
$$\begin{cases} x + 100 = y + z \\ y + 100 = 2x + 2z \\ z + 100 = 3x + 3y \end{cases}$$
 what is  $x, y$ , and  $z$  equals to?  
An.  $9^{\frac{1}{1}}$ ,  $45^{\frac{1}{15}}$ , and  $63^{\frac{7}{15}}$ .

8. Let there be given x-y=2, xy-5x-6y=120, to exterminate x. Anf.  $y^2-y=110$ .

9. Let 
$$\begin{cases} x+y=s \\ x^2-y^2=d \end{cases}$$
 quere x and y. Anf.  $\frac{s^2-1-d}{2s}$  and  $\frac{s^2-d}{2s}$ 

10. Let 
$$\begin{cases} x+y+z=12\\ x+2y+3z=10 \end{cases}$$
 quere x, y, and z? Anf. 6, 4, and z.

### QUADRATIC EQUATIONS.

A quadratic Equation is, when it involves one unknown Quantity, and at the fame Time the Square of that Quantity, and the Product of it multiplied by some known Quantity.

Of these Equations there are three Forms, viz.

$$xx+6x+12=52$$
 the first Form.  
 $2xx-6x+12=20$  second.  
 $6x-xx=8$  third.

### All of which may be refolved by the following

#### RULES.

1. Transpose all the Terms that involve the unknown Quantity to one Side, and the known Terms to the other Side of the Equation.

2. If the Square of the unknown Quantity is multiplied by any Co-efficient, you are to divide all the Terms by that Co-efficient, that the Co-efficient of the Square of the

unknown Quantity may be unit.

3. Add to both Sides the Square of half the Co-efficient prefixed to the unknown Quantity itself, and the Side of the Equation that involves the unknown Quantity.

will then be a complete Square.

4. Extract the Square Root from both Sides of the Equation, which you will find on one Side always to be the unknown Quanrity with Half the aforesaid Co-efficient subjoined to it, so that by transposing this Half, you may obtain the Value of the unknown Quantity expressed in the known Term.

Thus, by Rule 1, the three aforesaid Equations will become as follows,

first 
$$x^2 - 6x = 52 - 12 = 40$$
  
fecond  $2x^2 - 6x = 20 - 12 = 8$   
and third  $x^2 - 6x = -8$ 

And by Rule 2, the fecond Equation will become-

$$-xx\frac{6x}{2} = \frac{8}{2}$$
, confequently  $x^2 - 3x = 4$ .

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Then, by Rule 3, these three Equations will become as follows, viz.

first 
$$x^2 + 6x + 9 = 40 + 9 = 49$$
  
fecond  $x^2 - 3x + 2,25 = 4 + 2,25 = 6,25$   
and third  $x^2 - 6x + 9 = 9 - 8 = 1$ 

Also, by Rule 4, they will become as follows,.

first 
$$x - 3 = \sqrt{49} = 7$$
  
fecond  $x - 15 = \sqrt{6}, 25 = 25$   
and third  $x - 3 = \sqrt{1} = 1$ 

Then by the Rules of Reduction.

$$x = 7 - 3 = 4$$
  
 $x = 2.5 + 1.5 = 4$   
 $x = 1 + 4 = 4$  fo ,  $x = 4$ .

All Quadratic Equations may be following general Theorem:

Thus, suppose the second Equation was required to be resolved,

First let A=2, B=6, and C=8.

Then will it stand Axx-Bx=C.

Per Rule 2, xx-Bx=C.

Also, per Rule 3;  $xx - \frac{bx}{a} + \frac{bb}{4aa} - \frac{bb}{4aa} + \frac{c}{a}$ , but the two

Fractions  $\frac{bb}{4aa}$  and  $\frac{c}{a}$  when thrown into one give

abb--4aac which divided by a, gives bb--4ac, there-

fore  $xx - \frac{bx}{a} + \frac{4aa}{bb} = \frac{bb + 4ac}{4aa}$ 

Now let bb-1-4ac=ss, then the Equation will stand thus,

$$xx - \frac{bx}{a} + \frac{bb}{4aa} = \frac{ss}{4aa}$$
, then per Rule 4,  $x - \frac{b}{2a} = \frac{s}{2a}$ ,

therefore,  $x=\frac{b-1-s}{2a}$ , that is,  $x=\frac{b-1-s}{2a}$ , or,  $x=\frac{b-s}{2a}$ 

Q. E. F.

### EXAMPLES.

1. Suppose xx-4x=32, what is the Value of x? Anf. S.

2. Suppose 12xx-420x=-1200, quere x? Ans. 3,138594.

3. Suppose  $4x^2 + 60x = 216$ , what is x equal to? Anf. 3.

Suppose

Suppose a=216, or any other Number, and e=24, a lesser Number;

Then let 
$$\begin{cases} a - e = s = 240 \\ a - e = d = 192 \\ ae = p = 5184 \end{cases}$$

$$\begin{cases} a - e = d = 192 \\ ae = p = 5184 \end{cases}$$

$$\begin{cases} a - e = s = 240 \\ ae = e = 247232 \\ aa - ee = x = 46080 \end{cases}$$

$$\begin{cases} a - e = s = 240 \\ Product, \\ Quotient, \\ Sum of their Squares, \\ Diff. of their Squares. \end{cases}$$

Any two of these six Letters (s, d, p, q, x, z,) being given, to find the rest; which admits of 15 Variations or Questions, and are those which Mr. WARD has so excellently answered in his MATHEMATICIAN'S GUIDE.

Question 1. Suppose s and d were given, and it were required by them to find a, e, p, q, z, and x.

2. Let s and p be given, to find the rest.

3. Suppose s and q were given, to find the rest.

4. Suppose è and z are given, to find the rest.
5. Let s and x be given, to find the rest.

6. Suppose d and p are given, to find the rest.

7. Let d and q be given, to find the rest.

8. Suppose d and z are given, to find the rest.
9. Suppose d and x are given, to find the rest.

10. Let p and q be given, to find the rest.

11. Suppose p and x be given, to find the rest.

12. Let p and x be given, to find the rest.

13. Suppose q and z were given, to find the rest.

14. Let q and x be given, to find the rest.

le '

15. Suppose and x were given, quere the rest?

These fisteen Questions being pursued throughout, to find the Value of all the unknown Quantities, will afford a great Variety, and will be found to be of great Service to the Pupil, in the Solution of most Questions.

Note, I would advise the Learner, to use the same Numbers, for the respective Value of each Quantity, throughout all the Questions, as they will be more satisfactory in proving the Work, than various Num-

bers will be; not but any Number may be taken at Pleasure, provided the Number represented by a, be greater than that by e, &c.

The Pupil may make a Numerical Calculation in each

Question.

#### PROBLEMS.

1. What two Numbers are those, whose Difference is 20,

and whose Sum is 70? Answ. 45 and 25.

2. What two Numbers are those, whose Difference is 14, and the Quotient of the greater Divided by the less is 3? Answ. 14 and 7.

3. What Number is that, whose third Part, added to its

fourth, will be 21? Anf. 36.

4. What Number is that, whose third Part exceeds its fourth by 4? Ans. 48.

5. What Number is that whose third Part less 4 is equal to

its fourth less 25? Anfw. 45.

6. What Numbers are those, whose Difference is 8, and the Difference of their Squares is 208? Ans. 17 and 9.

7. What two Numbers are those, whose Sum is 60, and the greater is to the lesser as 9 is to 3? Answ. 45 and 16.

8. Find two Numbers, the Product whereof is 108, and the Triple of the greater divided by the lesser is 4? Answ.

12 and a.

9. Find two Numbers, to whose Sum, if you add 8, the Whole shall be Double the greater, and if you subtract 45 from their Difference, the Remainder will be Half the least? Answ. 15 and 7.

mainder, the second and one-third of the Remainder, and the third and one-fourth the Remainder, may al-

ways make 34? Answ. 10,22 and 26.

of the first Division may be three Times the major Part of the first Division, and the major Part of the second Division, and the major Part of the second may be double the minor Part of the first? Answ. 40, 60, and 20, 80.

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The Fences of a Field to find;
Triang'lar is the Form of Ground,
Its Area twice twelve Chains was found;
One Angle at the Base I knew,
Just thirty-fix and fifty-two;
And cub'd when every Side shall be,
The Sum you underneath may see\*.

13. Three Persons, A, B, and C, make a joint Contribution, which in the Whole amounts to 761. of this A contributes a certain Sum unknown; B as much as A, and 1001. more; and C as much as both A and B together; I demand their several Contributions? Answ.

A 141. B 241. and C 381.

14. There are 580 Men to be placed in an Oblong, whose Length and Breadth together make 52: How many in

each Side? Answ. 40 and 12.

us. Sold a Quantity of Tobacco for 19s. Part of which at 1s. per Pound, and the rest at 15d. now the first Part was to the latter as \( \frac{3}{4} \) to \( \frac{2}{3} \): How much was sold of each? Answ. 9lb. and 8.

16. After paying away 4 and 3 of my Money, I found 66 Guineas left in my Bag; what was in it at first? Answ.

120 Guineas.

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by the greater produces 77; and whose Difference, multiplied by the lesser gives 12? Answ. 7 and 4.

18. What Number, from whose Double to being subtracted, the Square of the Remainder less 1 will be equal to 7

Times the faid Number? Answ. 9.

19. A Father at his Death left, by his Will, 1000l. to be divided between his Son and Daughter, in such a Manner that \(\frac{1}{5}\) Part of his Share should exceed \(\frac{1}{4}\) Part of her's by 10l. show must the 1000l. be divided? Answ. Son, 577\(\frac{7}{9}\); Daughter 412\(\frac{2}{9}\)l.

20. The continual Product of four Numbers in Arithmetical Progression is 945, and the common Difference 2; what

are those Numbers? Answ. 3, 5, 7, and 9.

22. Three

<sup>\* 1728</sup> Chains=the Sum of the Sides cubed.



21. If to my Months you should add Half this Sume And one-eighth more, and then should subtract one. The Refidue would fuch a Number be-As twenty-one, being squared, affuredly?

Answer, 1272 Months, or 22 Years, 8 Months. 22. Three Numbers in Geometrical Progression are requir-

ed, so that the Difference of the first and second may be 6, and of the second and third 15? Ans. 4, 10, and 25.

23. To find a Number, from the Cube of which if you subtract 19, and multiply the Remainder by that Cube,

the Product shall be 216? Answ. 3, or-2.

24. Sixty Thousand brave Soldiers in Battle there were Plac'd on a vait Plain, and in Form a long Square: Now on how many Acres of Ground did they stand, At two Yards three Quarters between Man and Man; And how many in Rank and File will there be, When their Breadth to their Length is as two is to three?

Anfw. 92 A. 3 R. 35,2 P.

23. One Morning in May I went to survey, As foon as bright Sol I elpy'd;

I measured round a four-corner'd Ground,

The Margin's the Length of each Side The Angle at B, together with D,

An hundred and fifty Degrees; The Meadow's Content is all that I want,

CD=10.00 DA=26.00 Assist me, kind Youths, if you please. Answ. 21 A. 2 R. 0,64 P.

26. All the different Ways possible in which a Gentleman can place his Servants, conbining them by 1, 2, 3, &c. at a Time, 960799; what Number of Servants does he keep? Aniw. 7.

27. A Gentleman a Garden had, Five-score Feet long, and four score broad: A Walk of equal Breadth, half round, He made, that took up Half the Ground: The Figure in the Margin fee, How wide's the Walk? I pray tell to me.



A B=15.60

B C=13.20

30

31

23. A

A General, disposing of his Army into a square Battler finds he has 284 Soldiers over and above, but encreasing each Side with one Man, he wanted 25 to fill up the Square: Quere the Number of Soldiers? Answer, 24000.

Old John, who had in Credit liv'd,
Tho' now reduc'd, a Sum receiv'd;
This lucky Hit's no fooner found,
Than clam'rous Duns came fwarming round;
To th' Landlord—Baker—many more,
John paid in all, Pounds ninety-four.
Half what remain'd—a Friend he lent,—
On Joan and Self, one-fifth he spent;
And when of all these Sums bereft,
One-tenth o'th' Sum receiv'd had lest:
Now shew your Skill, ye learned Youth,
And by your Work the Sum produce. Ans. 141%.

30. In a Rectangle, ABCD, is given the Difference be tween the Length, AB, and the Diagonal, BD, that is, DE=2; likewise the Difference between the Breadth, AD, the Diagonal, BD, that is FE=9, required the Sides of the Rectangle, AB, AD? Answ.

AB = 15, AD = 3.

viz. A B=13, AC 14, BC=15, and the Perpendicular AD being drawn, required the Segment of the Bases BD, DC? Answ. BD=6, 6, and DC=8, 4. Suppose the Plate of a Looking-Glass is 18 Inches by 12, and is to be framed with a Frame of equal Width, and whose Area is to be equal to that of the Glass, the Width of the Frame is required? Answ. 3.

For more Examples, see Sect. 33 and 34.

### A few diverting QUESTIONS.

1. A Cheshire Cheese, when in one Scale, weighed 761b. but on being changed into the other Scale, it weighed only 561b. quere the true Weight? Ans. 65,19651b.

The General Rule for Questions of this Sort is, to multiply the two Weights together, and extract the Square Root of the Product, which Root will be the true Weight. 2. A Stone, weighing 40lb. is by Accident broken into four Pieces, by which may be weighed any Number of Pounds, from 1lb. to 40. Quere the Weight of each Piece? Answ. 1, 3, 9, and 27lb.

A General RULE for the Solution of QUESTIONS of this Nature.

To double the first or least Weight, which always contains one Pound, add 1, and it gives the second Weight.

Again, to double the Sum of these two Weights, add 1, it produces the third Weight: And again, to double the Sum of these three Weights, add 1, and we shall have the fourth Weight.

3. A certain Company being at a Public-House, their Reckoning came to 6s. \(\frac{1}{4}d\). the Number of Persons in Company were equal to the Farthings each spent: Quere, the Number in Company, and what each spent? Answ. 17 in Company.

The General Rule to answer Questions of this Sort, is to reduce the given Sum to its lowest Name mentioned, and of which extract the Square Root, which will be the Answer.

4. A Pack of Cards being laid into any Number of Heaps, fo that the Spots on the bottom Card of each Heap, added to the Number of Cards laid thereon, may make 12, by giving the Number of Heaps, and of the Cards left out to find the Number of Spots on all the bottom Cards?

QUESTIONS of this Nature are folved by the following Theorem:

Suppose n=the Number of Heaps,
r=the Number of Cards left,
w=the whole Pack,
x=the Number of Spots required.

Then, the Theorem will be, 13n-w+r=x, the Number of Spots required.

Suppose a Pack of Cards be dealt into 7 Heaps, and then there is 12 Cards left out: Quere, the Number of Spots on all the bottom Cards? Answ. 51.

5. What Dimensions must I give to a Joiner to make a Cubical Box that will hold 2000 Oranges of 21/4 Inches Diameter each, supposing the Oranges globular, keep-

ing

ing that Form, and laid in Rows exactly at the Top of

each other? Answ. 31,498 Inches inside.

6. A Master Joiner gives to one of his Men a Plank that is 10 Feet by 2, with Orders to make of it a Square Table, equal in Area to the said Plank, but not to exceed six Segments; the poor Man being ignorant of Lines (and not willing his Master should know it) would be greatly obliged to any who will draw the Plan how the said Plank must be cut and applied together?

7. A Person being asked what Hour of the Day it was, answered, it is between 5 and 6, and both the Minute Hand and Hour Hand are together: required the Hour

of the Day? Answ. 27-3 Minutes after 5.

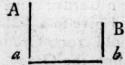
8. A Lady has a Dressing-Table, each Side of which is 27 Inches, but she is desirous to know how each Side of the same-may = 36 Inches, by having 4 Foot of Plank, superficial Measure, joined to the same. The Plan in what Manner the Plank must be cut and applied to the

Table is required?

9. A Gentleman purchases a Piece of Land in Form of a Parallelogram, and incloses one-fourth Part (as per Figure) to build a House and other Conveniencies upon; now he desires the Remainder of this Land may be divided into four Parts, equal and similar to each other, to be appropriated to such Uses as he shall hereafter think proper; the Plan is desired.

Parts, (Geometrically) by the shortest Line possible?

12. A Person, for a considerable Wager, is to travel from a Town, A, to another, B, but he is to call at a Place which is somewhere on the Line ab: Now his Time limited being very short, he is desirous to know (by Geometry) the Situation of the Place on the Line ab, the Distance from thence to A and Bibeing the shortest possible;



#### GENEALOGICAL PARADOXES.

1. Suppose two Women, and each a Son, were walking together, and were met by another Person, who asked the Boys in what Relation they stood to each other; they replied, we are Sons and Grandsons by the Father, Brothers and first Cousins by the Mothers, who also are Aunts to each of us. This combination of Kindred once happened, but in what Manner? See Gen xix.

who was he that was begot before his Father, born before his Mother, and had the Maidenhead of his

Grandmether.

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## A P P E N D I X,

August to each of as I am combination of

### CONTAINING

Various Forms of Acquittances, Promissory
Notes, Bills of Exchange, Letters of
Advice, Letters of Credit, Bills of Parcels, and Bills on Book Debts, all of which
are adapted to such Circumstances as occur in
real Business; to enter the Pupil in the Manner and Method of Commerce, and to make
him ready at Computation.

### A GENERAL RECEIPT.

R ECEIVED of Mr. A. B. the Sum of Fifty Pounds, in full for, &c. and of all Demands,

By me, C. V.

£.50 0 0

EN

### A Receipt or Acquittance for Rent paid.

Received this — Day of, &c. of Mr. E. F. the Sum of Thirty-two Pounds Sixteen Shillings, in Money, which, with Eight Pounds Four Shillings more, disbursed by the said E. F. for Taxes and Reparations of the Messuage, &c. he now occupies, situate, &c. makes in the Whole the Sum of Forty Pounds, and is in full of Half a Year's Rent, due

Gg3

to

to me out of the said Premises, at Martiamas-Day last. E fay received

Received this Sci of Wir. A. B. die Suiz of Five Country of Bind of 100% due to res. at Country and laft, on Bond foin the faid A. B. I for receive.

An Acquittance for Debt received of a third Hand.

Received this, &c. of Mr. A. B. by the Hands of Mr. C. D. the Sum of Seven Pounds, in full for certain Goods, &c. bought by the faid A. B. of me. I fay, received in full of all Demands,

Received this, &c. of A. C. Breening of of 17 . Let and Tellament of C.D. late of ---- No. deceased, the

By me. O. h.

By me, E. F.

Sur of Ore Handred Counts, in full of a Legrey bequesth An Acquittance for Money received in Part of a Debt due on Bond. Bond.

Received this, &c. of Mr. T. B. the Sum of Ten Pounds Ten Shillings, and Six Pence, in Part of Payment of a greater Sum, due to me on Bond, from the faid T. B. I lay received By me, C. G.

Frem See Socellare

Goods and Obactels.

Received this so of the A. h.

f. 10 10 6

An Acquittance for Money received by a third Person, for the ovisor val i die Use of another. of blockwoll rol smil

Rights and Credits, of C. D. late !

Received this, &c. of Mr. A. B. the Sum of Twenty Pounds, in full for Work done by C. D. for the faid Mr. A. B. I say received by the Order and for the Use of the faid Mr. C. D.

Note for a Book Duby

Received this, &c. of Mr. A. B. . Promiffor Note with Sum of Sixty Pounds, payable to me, or Orders was all

th

£. 20 0 0

ENTERON .

## All ys C. A Receipt for Intereft due on Bond.

Received this, &c. of Mr. A. B. the Sum of Five Pounds, in full for one Year's Interest of 100% due to me at Christmas last, on Bond, from the said A. B. I say received

By me, D. B.

An Aquirance for Dele received of a third Plan ? . 2

Note, Besides these Receipts to be taken on Payment of Money due on Bonds, it is proper to have each Payment mentioned on the Back of the Obligation.

## An Acquittance for a Legacy.

By me, E. T.

An Acquittance to an Administrator, on Payment of a Debt due from the Intestate.

greater Sum, due to me on Bord front the Eid T

The Control of the By me, G. H. 10

A. B. I fay received by the Order and or O. of 1 . A. A.

y

A Receipt proper to be taken upon a Person's giving a Promissory
Note for a Book Dibt.

Months after Date, which Sum, when paid, is in full of all Demands. I fay received in saved no le mind. W. B.

£. 60 o o constant moderal server and to have repriee Months attend) and a promise to pay 10 Min or Order, the Sum of Ten Pounds for Value receive

An A quittance for the Purchase-Money oa the executing of a Conveyance, to be indorfed on the Back of the Deed.

Received the Day and Year within written, of the withinnamed A. B. the Sum of Seventy Pounds, being the full Confideration-Money within mentioned to be paid to me. I fay received By me, E. T.

housest in the fluctual and items of the sector

Witness to the Payment }

Of the new time of persons in A Receipt for Writings entrusted in a Person's Hands.

Received this, &c. of A. B. of \_\_\_\_\_, &c. four feveral . Deeds or Conveyances; one of them purporting to be a Lease of -, &c. and made between -, &c. another of them to be an Assignment of the said Lease, and made between -, &c. and the other to be a Lease and Release, and made between -, &c. for which feveral Deeds or Writings I hereby promise to be accountable, and to re-deliver the same to the said A. B. on Demand.

Witness, &c.

The Form of Promissory Notes, of common Notes for Money. one Confidenting faction

The Form of one payable on Demand.

I promise to pay to A. B. or Order, the Sum of Twenty Founds, on Demand, for Value received. Witness my Hand, this first Day of January, 1772,

the Posterior a writing his Name on the Back of its and depart in Love one Party to whom he incends & ang of wal ni

## The Form of one payable at a certain Time.

London, January 4, 1772.

Three Months after Date I promise to pay to Mr. A. B.
or Order, the Sum of Ten Pounds, for Value received

By me, C. V.

£.10 0 0

### Form of one payable at fundry Times.

I promise to pay Sir A. B. or Order, the Sum of Thirty-six Pounds, in the Manner sollowing: Ten Pounds, Part thereof, three Months after Date, sixteen Pounds more the 20th of May next, and the remaining ten Pounds the 27th of July next sollowing, for Value received. Witness my Hand, at London, the 2d of January, 1772,

D. E.

£. 36 0 0

## Form of one for Goods received.

I promise to return A. B. Esq. or Order, on Demand, one Casket of Jewels, sealed, one hundred Ounces of Gold Plate, three hundred and sifty of Silver ditto, one hundred Carats of Oriental Pearl, and a sive-hundred Pound Bank Note.—Received of the said A. B. Esq. for Self and Company, March 4, 1772,

By me, G. F.

## Necessary Observations on Promissory Notes.

Promissory Notes, for a valuable Consideration. should always mention for Value received, if the Thing itself be not specified; this gives them Validity in a Court of Judicature.

A Promissory Note, mentioning Order, is indorsible from one Person to another, which is done by the present Possessor's writing his Name on the Back of it, and delivering it up to the Party to whom he intends to assign over his Property therein.

It is unnecessary to have a Premissory Note payable to Bearer indorsed, if you are satisfied the Note is good.

The delivering up a Premissory Note to the Person who figned it, is a sufficient Voucher of its being paid, nor is there any Need of writing a Receipt thereon.

Promissory Notes, and Book Debts, if not legally demanded in the Space of fix Years, cannot be recovered by

Law.

If you have a Promissory Note on Demand in your own Hands above three Days, and the Person it is upon should fail, the Loss will be your own; but if he fail within the three Days, it will light in Equity on the Person that paid it you.

Forms of Inland Bills of Exchange.

Form of one payable at Sight.

£ 100

Bristol, Jan. 14, 1772.

At Sight pay Mr. J. B. or Order, the Sum of One-Hundred Pounds, the Value received of G. H. and place it to Accompt, as per Advice from

To Mr. C. D. at the Horse-Guards, Whitehall, London, A majer of Signord

Form of one payable after Sight.

£. 64 17.6

London, June 12, 1772.

At Ten Days Sight pay Mr. W. S. or Order, the Sum of Sixty four Pounds, seventeen Shillings, and Six Pence, for Value received of T. J. Esq. and place it to Accompt, as per Advice from andangalo Distraction

To Mr. J. W. Clothier,

Salifbury.

Form of one payable after Date.

L. 70

Edinburgh, July 2, 1772

Three Months after Date pay Sir J. W. or Order, the Sum of Seventy Pounds Sterling, Value in ourselves, and place it, without more Advice, to the Accompt of

To Sir T. B. Lombard-

T. & J. B.

Street, London.

N.B.

N. B. If Sir J. W. fer. Is his Servant G. H. to receive this Bill, after he has endorfed it, which is his Order, the Servant may write over it,

Received, October 5, the Contents,

T. W.

£.70 0 0

Witness, G. H.

Or only Witness will serve; and so of any other.

Men of great Business seldom trouble themselves with Receipts and Payments of Cash, but give an Order on their Banker; thus,

£. 40

London, Nov. 7, 1772

Messrs Fox and Payn,

Residence in his Employers

Pay Sir T. S. or Bearer, Forty Pounds, on Account.

T. W.

#### Another.

Mr. James,

York, June 4, 1772.

Pay Mr. T. R. or Bearer, One Hundred Pounds, on Demand, and place it to my Accompt.

To Mr. G. Fleet-Areet,

W. T.

London.

. W . Form of Foreign Bills of Exchange.

For Crowns 600, at Usance.

London, July 12, 1772.

London on Paris, S. or Order, Six Hundred Crowns, for the Value here received of Sir S. T. and place it to Accompt, as per Advice from

To Mr. W. R. Merchant, at Paris.

For Crowns 600, at Usance.

London, July 12, 1772.

Second At Usance pay this my Second of Exchange, my Bill. First not paid, to T. S. or Order, Six Hundred

dred Crowns, for the Value received of Sir S. T. and place it to Accompt, as per Advice.

To Mr. W. R. Merchant, at Paris. G. W.

£. 602 15s. 34d. Sterling, at 34s. 3 London, Sept. 6, 44d. per £. Sterl. at Usance. 3 1772.

London on Rotterdam, First Bill.

At Usance pay this First of Exchange to J. V. or Order, Six Hundred and two Pounds, fifteen Shillings, and Three-pence one Farthing Sterling, at Thirty and Four Pence Farthing Flem. per Pound Sterling Value, of S. T. Esq. and place it, as per Advice, from Your's, &c.

To Mr. S. C. Merchant, at Rotterdam. A.B.

Form of a Factor's Remittance to bis Employer.

For Crowns 700, at 54d. Sterl.

Genoa, May 4, 1772.

At Twenty Days Sight pay this my First of Exchange to T. G. or Order, Seven Hundred Crowns, Exchange at Fifty-four Pence per Crown, Value received of the Lords of the Regency, and place it to the Accompt of Mr. W. S. of Lyons, as per Advice from him.

To Mr. F. B. Banker, Lombard-Street, London. G. W.

Monsteur W. S.'s Letter, advising bis Concurrence to the aforementioned Draught.

SIR.

Lyons, May 29, 1772.

Brother G. W. of Genoa, has this Day defired me to furnish him with Seven Hundred Crowns, payable to the Resident of the States, at London: I have therefore ordered him to draw for the said Sum on you, which please to homour as usual, and put it to the Accompt of

Your Friend and Servant,

To Mr. F. B. Banker, Lombard-Street, London. W. S.

Form

Form of a Draught on the Employer, for Value of Goods, shipped him per Factor.

Milrees 400, at Usance,

St. Andrews, June 24, 1772.

North-Britain 3 on Lifbon,

At Usance pay this my First of Exchange to Mr. E. R. or Order, Four Hundred Milrees, the Value here shipped for your Use, upon the Santa Maria, of Naples, and consigned, as per Advice, from your very humble Servant,

To Signior Santilena, at Lisbon. M.G.

Form of an Employer's Letter, with Remittance to his Factor, in a Bill of the said Factor's Correspondent.

Mr. T. D.

According to your Desire, I have remitted you Four-Hundred Crowns for my Accompt, in your Correspondent. B.'s Bill inclosed, payable by and to yourself; for which please to give me Credit. I recommend the Contents of my last and the 4th Current to you, and rest

Your Friend and humble Servant,

Paris, Sept. 14, 1772.

E.B.

For Crowns 400, at 34d. per Crown.

Paris, Sept. 14, 1772.

At double Usance pay this my only Bill of Exchange to myself, the Sum of Four Hundred Crowns, Exchange at Thirty-four Pence Sterling per Crown, the Value received of Mons.

E. B. and place it, as per Advice, to the Accompt of

To T. D. Merchant,

B.'s

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Form of the Correspondent's Letter of Advice.
Mr. T. D.

SIR,

Paris, Sept. 14, 1772.

By this Post I have drawn on you for Four Hundred Crowns, at 34d. payable to yourself, Value of Monsieur E. B. which, with my other Bills depending, please to honour, and the timely Remittance shall be punctually made you by, Sir, your very humble Servant.

To Mr. T. D.

B.

Merchant, Briftol.

## Form of Letters of Credit.

London, June 12, 1772.

Please to furnish the Bearer hereof, Mr. T. C. with the Sum of One Hundred Pounds, as he shall require the same, and place it to my Account. for which this Letter of Credit, with his Receipt, shall be your sufficient Voucher and Warrant, giving upon Payment a Line or two of Advice to Your real Friend.

To Mr. A. B. Merchant, at Hull. S. E.

#### The Receipt.

Received, July 1772, of Mr. A. B. the Sum of One Hundred Pounds, by Virrue of Mr. S. E.'s Letter of Credit of June 12 last, for the faid Sum, per

M. N.

### £ 100 0 0

SIR,

Dublin, May 7, 1772.

The Bearer, Mr. T. V. will have Occasion for Sixty Pounds, which Sum I desire you to surnish him, and take his Bill for the said Sum, or any Part thereof, in the Honourable W. B. Esq. I am, Sir,

Your humble Servant,

To H. H. Efq.
Fleet-fireet, London.

R. K.

Exch.

Exch. £. 70

SIR,

June 4, 1772.

The Bill.

At twelve Days Sight pay this my First of Exchange to H. H. Esq. or Order, the Sum of Seventy Pounds, the Value received of Ditto, for your Use, as per Advice from, Sir,

Your humble Servant,

To the Hon. W. B. Efq. Dublin. T. V.

In this Bill the then current Exchange, suppose 121. per Cent- is to be added to the Sum ordered in the Letter of Credit, which send indorsed to A, with these Words:

Pay Mr. C. A. or Order, Value in Accompt.

H. H.

And if A. should have Occasion to indorse it to some other Person, thus:

Pay T. W Efq. or Order, Value of Ditto.

C. A.

The last Possession will be thereby entitled to the Contents from the Honourable W. B. when due. This Affair might also have been transacted without Indorsement, in Manner following.

Exch. £. 70

ty

ke O-

ch.

SIR,

June 4, 1772.

At Twelve Days Sight pay this my Second of Exchange, my Pirst not paid, To R. K. Esq. or Order, the Sum of Seventy Pounds, the Value received for your Use, of H. H. Esq. as Advice from

Your humble Servant,

To the Hon. W. B. Efq. Dublin.

T, W.

Form of a General Letter of Credit, to furnish a Person according to bis Occasion.

SIR, Paris, May 12, 1772.

The Bearer, Mr. A. B. one of his Britannic Majesty's Messengers, being ordered to Constantinople, will have Oc-

casion for Money to defray his Charges, &c. Please to furnish him with the Sums he shall require at the said Place, taking his Receipts, and your Draught for the Value shall receive due Honour from

Your humble Servant,

Monsieur C. D. Banquier, a Vienna. M. W.

The Bill consequent to this Letter of Credit, drawn by C. D. at Vienna, on B. at Paris, for the Sum furnished A. B.

For 600 Flo. at Liv. 31. 41. 0d.

SIR,

Vienna, June 2, 1772.

Cant is to be added to t

Credie, watch fond to

At three Days Sight pay this my only Bill of Exchange, to E. F. or Order, the Sum of Six Hundred Florins, Exchange, at three Livres four Sols per Florin, the Value paid at Constantinople, to A. B. pursuant to your Letter of Credit, of the 12th of May last, and as by Advice from the said A. B.

A Monfieur B.
Banquier, a Paris.

R. S.

1. . s. d.

Bills of Parcels, and Book Debts.

Mr. A. B.

Bought of THOMAS GROCER, Jan. 2, 1772.

Constitution of the said	L. s. d	•
11b. of Green Tea, at	0 17 6	per lb.
12lb. of Bohea, -	0 7 10	
5 Hundred of Tobacco,	3 6 0	per C.
10 Barrels of Raifins,	2 6 4	per Bar.
olb. of Pepper, -	0 2 9	per 1b.
7lb. of Brimstone,	o 1 8	<del>1</del>
8lb. of Coffee; -	0 12 9	
77 oz. of Mace, -	0 1 6	per oz.
	AND DESCRIPTION OF THE PARTY OF	

Cover New Medalters and The Contract of the Co

£ 66 16 6

Mrs.

#### Mrs. T. C.

Bought of Thomas Stuk-Mercer, Jan. 7, 177
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Mary Control of the C	1. 人,对 图像	s. d.	·f.	s. d.
20 Yards of Brocad	led Sattin, a	t 17 9 pe	rY.	
36 Yards of Moha	ir,	- 10 8 -		
86 Ditto of Green	Silk Damask	, 19 114 -	_	
100 Ditto of Padua		- 11 10 -	-	
9 Ditto of double		3 9 -	-	
12 Yards of -		- 5 6 -	_	
6 Yards of		9 114 -	<del></del> - b ma	
-42 Yards of	-	- 10 6 -		

£. 211.19 86

The Hon. Lady B.

Bought of J. LINEN-DRAPER, Jan. 6, 1772.

•	s. d. f. s. d.
80 Ells of Dowlass,	at • 111 per Y.
96 Ells of Holland,	- 5 7½
19½ Ells of Diaper,	- 1.7 - 1.3 de la companya dela companya dela companya de la companya de la companya de la companya dela companya de la compan
274 Yards of Damask,	- 4 10 <del>1</del>
12 Yards of Muslin,	and the second of the second
241 Elle of Cambric,	<del>-</del> 50 <del></del>

£ 62 9 34

Madam B.

.11

Bought of B. MILLINER, Jan. 4, 1772.

26½ Yards of blue Ribbon, at 2 6 per Yd.

12. Fans, French Paper Mount, 4 9 each.

6 Pair of Roman Gloves 9 6 per Pr.

4 Dozen of frish Lamb ditto, 1 10½——

6 Sarsnet Hoods, white, 5 11 each.

A Piece of Mechlin Lace, 12 Y. 17 6 per Yd.

£. 25 15 9

Mrs.

#### Mrs. F. PINDUST,

		Bought	of T	HOMAS	Hosier,	Jul	y 12,	177	12	
--	--	--------	------	-------	---------	-----	-------	-----	----	--

28 Pair of Th	read Stockings	at A.		£. 5 %
- 1 Dozen of	Worsted, mixt	- 3 10		
18 Pair of Str	awberry Hofe,	-4		16010184
16 Pair of Sil	k Gloves,	- 5.1	I TO	condition:
74 Pair of No	rwich Hofe,		6 5 1000 10	OHICE WAY
17 Pair of Me		—— 3 ·	0	12 Yards
11 Dozen ditt	o, Silk,	- 16	6 ——	abia Varia

£ 43 12 4

#### Mrs. ANN SCOT.

in with a con-

## Bought of JOHN FRUITERER, May 7, 1772.

d. 6 Dozen of Lemons, at 2 10 per Doz.

4 Hundred of Lifbon ditto, 6 6 per Hud. 6 10 Rapes of Onions, - - g each of to the

17 D. Seville & China Oranges, 4 6 per Doz. A Bushel of Chefnuts,

-4 10 dillaMile das 6 Dozen of Pomegranates

f. 8 16 6

Discher L

#### Mr. C. Toms.

## Bought of James DRAFER, February 4, 1772.

s. d. 2 Yards of Broad Cloth, at 18 6 per Yd.

Yds, of fine Spanish Black, 17 4 14 Yards of fine Grey Cloth, 16 10

61 Yards of fecond Drab, — 12 8 ——
272 Yards of Shalloon, — 1 9 ——

19. Yards of Serge, - 4 102

£. 48 15 10\$

Mr.

#### Mr. W. L.

A STATE OF THE STATE OF	The State of the S			
Bought o	of Andrew	OFF MAN	March	TM43
Dought	I TINDEEN	OIDMAN,	waitin /	, 1//40

s. d.	
12lb. of Anchovies, at 1 6 pe	r lb.
611b. of Capers, - 0,1112 -	
26lb. of Salt, - 0 94-	
4 Gallons of pickled Mushrooms, 3 6 pe	r Gal.
3 Gallons of Lucca Oil, 10 6 —	of the
12lb. of Salt-Petre, - 1 41 pe	r 1b.

£. 5 6 01

## JOHN JONES, Efq.

01 30

# Bought of THO. CHEESEMONGER, Jan. 16, 1772.

A CALL OF THE STATE OF THE STAT	C. gr. 1b	. L. s.	d.
6 Old Cheshire Cheeses, 1	Wt. 2 2 1	4 at 2 4	6 per C.
4 Glocestershire ditto,	2 2 2	1 16	1
8 Flitches of Bacon.		e,— o 2 1	
10 Firkins of Butter,	E Comment	—I 12	
24 Stilton Cheefes,	62 0	1 17 1	
3 Weys of Suffolk Butter,		6 12	
manufacture and the second		3555 B	
manufacture and the second		10 8 N 20 8 R 10 8 PM	

£. 69 3 44

#### Sir Matthew LAMB,

Bought of NATH. WINE-MERCHANT, Oct. 4, 1772.

	f. s. d.
12 Dozen of Claret Wine, a	t 1 17 6 per Doz.
	- 0 9 6 per Gal
2 Hhhds. of old Mountain,	
	- 1 10 6 per Doz.
	- 2 19 10
	- 0 19 10

£. 113 16 3

Mrs.

4

#### Mrs. B.

7772.

Bought of J. Butcher,

1b. d. L. s. W. Jan. 2. A fore Quar. Lamb, wt. 10 at 43 p. 1b.

29. Ditto of Pork, - 14 - 5 --

Feb. 4. A Buttock of Beef, — 49 —  $4\frac{1}{2}$  ——

10. A Fillet of Veal, —  $11\frac{1}{4}$ —  $5\frac{3}{4}$  ——

27. A Surloin of Beef, — 26 —  $4\frac{1}{2}$  ——

Mar. 6. Beef Steaks, 6. Beef Steaks, —— 10 — 53 — 14. A Saddle of Mutton, 17 — 44 —

f. 2 16 10}

JOHN THOMAS,

added tample was a Bought of J. Corn-Chandler, March 4, 1772.

s. d. 4 Quarters of Barley, at 16 9 per Quar.

12 Bushels of Wheat, - 5 9 per Bush.

7 Ditto of Oats, - 11 9 per Quar.

20 Bushels of Beans, - 4 6 per Bush.

g per lb. d. 18lb. of Hops,

4 Loads of Hay, - 2 16 per Load.

£. 25 9 61

Sept. 6, 1772.

experience.

Mr. Jones, Dr. To J. Coal-Merchant,

f. s. d. . . fo s. d.

4 Sacks of Coals, at 1 19 6 per Ch.

aldron of ditto, 1 10 0 -

cks of ditto, -1 14 6 --cks of ditto, - 2 2 0

oril 6. Sacks of ditto, - 1 18 9-

20. 3 Sacks of ditto, - 2 5 0 --

5 DE60, L. 12 11 64

FINIS.

